THE PSYCHOLOGY OF SELECTING MEN

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SECOND EDITION

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To

THOSE WHO ARE FURTHERING INDUSTRIAL EFFICIENCY AND HAPPINESS BY STUDYING HUMAN BEINGS IN THE SPIRIT AND WITH THE METHODS OF SCIENCE —MAY THEIR NUMBERS INCREASE!

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PREFACE TO THE SECOND EDITION

That two printings and a second edition of this book have been called for within eighteen months of its first publication indicate rather the growing interest and rapid developments in the psychology of selecting men than any particular merit of the book.

In this new edition, chapters have been added which point the way for the employment department to utilize definite tests in the selection of applicants. These supplement the earlier chapters which demonstrate the great need for an improved selection and outline the technique to be followed in effecting an improvement.

In the newer chapters, it has been necessary in places to use common sense where mathematical demonstrations are sometimes equivocal. For this no apology is offered, but the hope is here expressed that the work, which it is the aim of this book to stimulate, will supply the mathematical bases before these pages have lost their luster.

DONALD A. LAIRD

COLGATE PSYCHOLOGICAL LABORATORY
HAMILTON, NEW YORK
February, 1927

PREFACE TO THE FIRST EDITION

This book is a product of necessity, born of a need experienced while teaching in the classroom and in introducing psychological methods of selection to industrial leaders.

The purpose is to set forth a technical account, in a non-technical way, of the fundamental considerations in selecting men. The first portions of the book constitute a critical survey of traditional methods; the latter portions, a description of the scientific methods of selection.

To some it may seem more mathematical than psychological. That may be because they confuse psychology with inspirational advertisements, or for the reason that it has been necessary to use the language and tool of science. To others it may not seem mathematical enough. Such an opinion may result because it has been thought best to give the student entering employment work, or the man already in it, a practical tool that he can readily understand, leaving his further advance in the use of statistical methods to his desire for professional progress.

It may seem negative in tone. If such is the case, it is because much needs to be undone and what is new needs to be undertaken with proper precautions continuously before us. My attitude is not negatory, but I try to temper my enthusiasms with the guiding restraint of scientific methods. I hope my book will accomplish this for its readers who have not previously found these methods employed.

Donald A. Laird

Colgate Psychological Laboratory
Hamilton, New York
March, 1925

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New illustrations in the second edition are reproduced through the courtesy of Dr. John J. B. Morgan, Dr. Fred A. Moss, and Mr. W. C. Wideman of the C. H. Stoelting Company.

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TO THE READER

THE charts in this book tell a story. Many of them are not referred to in the text. Study each chart carefully before turning to the next page.

THE PSYCHOLOGY OF SELECTING MEN

CHAPTER I

INTRODUCTION

The executive purchases a gift of silverware; it is guaranteed to show no evidence of wear for 20 years. The same executive employs a stenographer in the usual manner; he cannot tell whether or not she is competent until after she has been in his service for 6 months.

The plant superintendent requisitions certain machines; he knows in advance just how much work and what kind of work to expect from each. When he requisitions help, he is not so certain that he will get what he wants. In fact, it is a foregone conclusion that in many cases the requisition for help will be filled most unsatisfactorily. Least uniformity appears in the human element in industry, and lack of proper stamina manifests itself almost unwarned, while the capacities of the mechanical equipment are represented by engineer's ratings.

Psychology is now reaching the point where it is also possible to have ratings of the capacities and stamina of the human beings engaged in business. Much has already been done in handling the human element in industry, but vastly more remains to be accomplished. Increasing attention is being given to the selection and maintenance of these human mechanisms of muscle and nerve. Most attention has been given to the *maintenance* of these individuals; as yet, the majority of plants have not shown the same foresight in the *selection* of their workers. Medical and nursing care, oftentimes accompanied by home visits, is not uncommon at present. But similar, careful attention is rarely given to the initial selection of workers. Qualified specialists have not made certain that each employee is in the work for which he is best fitted and which will bring him the maximum of interest and happiness. There are two important causes that

have determined this course of industrial developments. Both of these are largely beyond the control of those directly concerned in industry, either in the capacity of worker or employer.

Health legislation and compensations laws, in the first place, have served to focus attention upon the maintenance of the health of the worker. In some states, periodical medical examination is demanded by law of employees engaged in occupations in which the health hazard is great. Collateral development from this is apparent in the medical examination before employment so that the employer may be certain he is not hiring one whose physical condition is such that the health hazard will be accentuated. The motivation is the necessity for the employer to protect himself against claims. Further development of medical examinations seems to have been actuated by the belief that the worker in good health is better and more efficient than one in poor health.

A second reason for the direction of the employer's attention to the maintenance rather than to the selection of his workers lies in the dearth of accurate information regarding scientific selection. In the meantime, he has continued the usual, haphazard method of employing those who applied "for a job," regardless of their fitness.

This does not mean, however, that this field has lain fallow except for occasional outbursts of propaganda. The apparent lull has in reality been marked by considerable activity, evidences of which are hidden in scientific journals and research laboratories. Psychologists and others, with genuine scientific interests, have been busily engaged in testing the propaganda, and a large number of valuable contributions of sound scientific reliability have appeared.

It is the purpose of this book to formulate for the employer the principles to be followed in the use of scientific methods when selecting workers. Too much emphasis cannot be placed on the necessity for those engaged in employment work of any sort being familiar with the principles that underlie the scientific selection of men. Common sense, when it has not been schooled in the methods of science, cannot be considered a competent guide in these matters.

THE PSYCHOLOGICAL UNDERWORLD

The popular awe in which psychology is held and the great expectations most people have of it have led to a peculiar situa-

tion. When an accountant is engaged, it can be taken for granted that he is qualified, because he must satisfactorily pass state examinations before he can be certified. When a physician is called, it can be assumed that an impostor is not reporting, since state examinations also regulate the practice of medicine. An engineer is usually not so certified by the state but his qualifications can be roughly determined by his university and technological records and diplomas.

In engaging a psychologist, however, the employer faces a difficulty. Anyone can call himself a psychologist and not come into conflict with the law. At present, there are no restrictions placed upon *anyone* setting himself up as a professional psychologist, and no legal machinery exists for certifying to his proficiency as a psychologist. The natural result is that there are many persons in this country gaining a livelihood as psychologists who are no more qualified than they are to practice brain surgery. Some of these charlatan psychologists are in industry, giving "psychological advice" and effecting "psychological reorganizations," when they have never taken a course in psychology and indeed are not familiar with the subject. Needless to state, they are unable to render any service to industry that the person intimately concerned could not do better himself and, in instance after instance, they have done actual injury.

Organizations of psychologists, consequently, are striving to have legislation enacted that will forever rid industry and professions of this blight of the untrained and poorly qualified person who assumes to be a psychologist. Until the time comes when an employer can engage a person with state credentials as a certified public psychologist, it will be necessary for less effective criteria to be used in his choice, but every precaution should be taken to make certain that an impostor is not being obtained.

To illustrate the fact that the above paragraphs are not overdrawn, let me give four examples of "practicing psychologists" with whom I came into contact within a period of 3 weeks. A few summers ago, it was necessary for me to travel extensively through some of the central western states. In Grinnell, Iowa, I met an impressively dressed man who was doing "psychological work" there. He had been in the town a week giving lectures, holding conferences, and giving business advice. Keeping my interests to myself, I became well enough acquainted with him

to discover that until 8 months previous he had been a salesman with a wholesale silk house. He had never attended a single course in psychology. His sole educational preparation was some night school courses in advertising and selling. He was as ignorant of psychology as the classical Man from Mars, and his advice and conferences were as ill-founded as Canute's attempts to stop the tides. Although I made several attempts to find out if he were an intentional faker, they met with no success and it must be granted that he seemed tremendously in earnest.

On the train a few days later, my attention was drawn to a man making a meal of soda pop, sardines, and crackers. After I had become acquainted with him, I learned that he was giving public lectures on "psychology." During the winter, he was an evangelist. He was rather frank in telling me that his summer lectures were very much like his evangelistic sermons except that he kept religion in the background. He was also frank in saying that he had no psychological training and that he had called his lectures "psychological" because the term drew larger crowds. He justified himself by giving me assurance that his lectures were of immense personal benefit to his auditors whether they were really given psychological advice or not.[1]

A few days later, at Grand Forks, I met one of the most energetic busybodies I have ever seen. He was a "business psychology expert" who was fleecing the business men there. His preparation for the psychological work consisted of a Y.M.C.A. course in physical training.

I next made the acquaintance of a "vocational psychologist" in his home village, where he lived a rather solitary life. He had been a minister who was unfrocked because of his delinquencies with the boys of the town, but who now spent a large part of his time holding "psychological conferences" with high school youths, in whatever places he could sell his services to the school authorities or luncheon clubs. There is no reason to believe that these four instances are not representative of certain, actual conditions.

[1] Incidentally, it should be mentioned that lectures called "psychological" draw large crowds, as is witnessed by the 6-day series given at Washington, D. C., which netted the lecturer $30,000. One who attended this series told me that they were something like modern dancing: the lecturer made up his psychology as he went along.

But not only is business being victimized by pseudo-psychology; in Chicago, there are several new religions that are called psychology of one kind or another. New York has its quota, and the Pacific coast suffers more from this than from the I. W. W., although it may not be realized there. One man has an "applied psychology" cult based upon the letters in Roosevelt's name. Another is organizing, with a profit of $20,000 annually, "psychological clubs" in which the soul is linked up with Becquerel's rays. He is now extending his activities to foreign lands.

How psychological are these? Just as much so as Get-Rich-Quick Wallingford and no more. The orthodox psychologist who tries to stand on his scientific feet often finds his intellectual breath taken away by these strange bedfellows. Such was my experience in a gathering, when it became rumored that I was a psychologist, and only the most courageous dared approach me. A tall spinster—hands and arms encased in black gloves, a butterfly of brilliants in her rusty hair—came to me and said, "I'm a psychologist, too! Who is *your* control?"

The following, taken from *The Nation* of Feb. 13, 1924, is a fair presentation of this sort of "applied psychology:"

For some weeks we had been noticing in the paper that the Society of Applied Psychology met in the public library on Wednesday evening. So, when an open meeting was announced, we spent a dollar to have the children taken care of and went to see what it was all about.

The room was in the cellar of the library, inadequately lighted and furnished with folding chairs on which, in brightly expectant attitudes, sat eight or ten men and thirty or forty women, of an average age of thirty-five or forty and mostly with that thin, drawn, but determinedly hopeful, look of half-starved dogs. The front wall above the shallow platform was covered with a huge American flag forming a background for a grand piano and a small deal table. Behind the table sat a lean, artificially colored lady, her mouth a thin red line of courage—or was it obstinacy? Beside her sat a severe lady with horn-rimmed glasses, wearing a black dress with white collar and cuffs, who toyed with a long black covered book. Lounging about in attitudes meant to betoken ease and self-confidence was a gentleman in correct black clothes, black hair, curly black mustache, and with a red rose in his button hole.

The thin red line of the chairwoman parted sufficiently to emit muffled sounds to the effect that the meeting was open. The gentle-

man with the button-hole bouquet advanced toward the front rows with a confident smile and shouted in a hearty voice:

"How do we all feel this evening?"

To which the answer came back in startling unison:

"Fine and dandy and getting better every day!"

"Very good," said the gentleman in black.

It seemed evident that this gentleman was the Applier for the Society of Applied Psychology, for he proceeded to say in engaging tones:

"You know you can't be a psychologist without relaxin' to get in tune with the universe. Most folks don't relax because they can't concentrate on the part they want to relax. We aren't conscious of the parts of our body and have to concentrate to relax 'em. Now we'll relax from the tops of our heads to the tips of our toes. I want you to relax by concentratin' your attention on the part of your body as I name it and relaxin'. Are you ready?"

All bent forward as if in prayer and shut their eyes.

"The top of your head—relax.

"Very good.

"Your mouth and ears—relax.

"Very good.

"Your chin and neck—relax.

"Very good.

"Your right arm and shoulder—relax.

"Your left arm and shoulder—relax.

"Very good.

"Your hands and fingers—relax.

"Your chest and back—relax.

"Very good.

"Your hips and thighs—relax.

"Your knees and legs—relax.

"Very good.

"Your feet and toes—relax.

A pause

"Very good—very good!

"Now you know they say you can't be a deep thinker unless you are a deep breather, so we will take a breathin' exercise. We'll all have to stand up for this." (Everybody got up.) "Take a deep breath and count."

Everybody took a deep breath hissingly and counted in unison 1-2-3-4-5-6-7-8-9-10-11-12-13-14 (some of them began to come up for air but they valiantly continued counting anyhow) 15-16-17-18-19-20. The last number was shouted by a large lady in the back row who seemed quite proud of her ability to hold her breath and count longer

than anybody else. Whereupon the Applier seemed pleased and said:

"Very good—very good.

"Next to relaxin', the most important thing for a psychologist is concentration. We should all learn t' concentrate, and I want somebody t' give us a constructive word t' concentrate on, and while we're concentratin' we'll have a little soft music to help us."

Someone suggested "harmony."

" 'Harmony' has been suggested as a constructive word to concentrate on. Very good—very good. We will concentrate on 'harmony.'" He put his hand over his brow in thought and the members of the Society of Applied Psychology did likewise, while a lady in a large hat with a feather went to the piano and played soft music, her feather keeping time with her hands and feet.

All breathed hard while they concentrated on the constructive word "harmony" and the soft music went on.

The music stopped. The Applier lifted his hand from his brow with an effort.

"Very good," he said.

By that time my wife said if she didn't get out in the air she would undoubtedly scream, so we left. She said she felt sorry for them, they looked so starved and hopeful, but what hurt her worse than anything else was to know that such people had a vote.

I think I got something out of the meeting. I know now why Christianity was so successful at the break-up of the Roman Empire. The vast majority of the people of that day were just such mentally and physically starved and just such empty-souled, hopeless specimens. To have a hope and to live for something outside of themselves offered a new world and new life; these people were seeking the same thing and not finding it in present-day Christianity. How are you going to reach them with new ideas? They are seeking for something and, not finding it, are swayed by every passing gust of fancy or every hope held out by every well-meaning fool. You cannot get them by reason, statistics, or a constructive program. A "constructive word" is about their limit and their minds are excrescences on their emotional complexes. What are you going to do with such people—breed them out of the world by restrictive eugenics or give them something to live for?

WHERE TO GET PSYCHOLOGICAL AID

Sources of Psychology.—The first question confronting the business man interested in employment psychology naturally is in the selection of an employment psychologist. It has been stated that efforts are being made to obtain state regulation of practicing psychologists. Some states at present do have quali-

fying regulations imposed upon psychologists who certify feeble-minded persons as needing state care and supervision. This is obviously a service that is not of paramount importance in industry, although it may be of some usefulness at times in employment, as later chapters will show.

When a business man is in search of reliable psychological advice or information, he should be vigilant to see that the one he approaches meets certain specifications. These may be arbitrarily set as follows:

1. The doctor's degree in psychology which represents three years' graduate study and research in psychology in addition to the usual college courses. Not all "doctors" are of equal merit in this connection. The Ph.D. and D.Sci. degrees represent real scientific training and are the ones to be sought. Degrees such as D.D., D.C., LL.D., and D.Litt. mean nothing so far as psychological and scientific preparation is concerned. The degree of M.D. is in a doubtful middle ground.

There are some well-qualified men doing psychological work who, nevertheless, do not possess a doctor's degree. The degree in itself is no certification of proficiency and is, in many instances, misleading. But it will protect the business man if he expects it from those who offer him their services for this work.

2. A second requirement, and at present a very important one, should be published experiments in economic psychology. This requirement is necessary due to the present incomplete status of business psychology. All business and industrial problems have not been settled experimentally and it is still necessary for one to have experimental training and abilities if he would engage in successful work in this field. Perhaps in the future there will be enough accumulated knowledge for one to be able to practice psychology in the field of business and industry without the necessity of having experimental abilities, but now no set of "cook book" practices can be formulated. In published experiments it is always well to look for tables of data, and not consider simply having written results, as adequate without gathering and studying data. To have been engaged in industrial or economic work in the guise of psychology is in itself no assurance that the qualifications are satisfactory or the alleged performance significant.

The Psychological Corporation.—This is an American holding corporation for psychologists of high professional standing.

The central offices are in the Grand Central Terminal in New York City; the president is Dr. J. McKeen Cattell. This office can put one in touch with the proper persons and facilities for psychological counsel. Branch offices and stations are established as follows:

California: Dr. Warner Brown, Secretary, University of California Berkeley, Cal.
Central New York: Dr. Donald A. Laird, Hamilton, N. Y.
District of Columbia: Dr. L. J. O'Rourke, Washington, D. C.
Illinois: Dr. Frank N. Freeman, Secretary, University of Chicago, Chicago, Ill.
Indiana: Dr. H. D. Kitson, Secretary, University of Indiana, Bloomington, Ind.
Iowa: Dr. Bird T. Baldwin, Secretary, Iowa Child Welfare Research Station, Iowa City, Iowa.
Kansas-Missouri: Dr. Max F. Meyer, Secretary, University of Missouri, Columbia, Mo.
Maryland: Dr. Knight Dunlap, Secretary, Johns Hopkins University, Baltimore, Md.
Massachusetts: Dr. Herbert S. Langfeld, Secretary, Harvard University Cambridge, Mass.
Michigan: Dr. H. F. Adams, Secretary, University of Michigan, Ann Arbor, Mich.
Ohio: Dr. Harold E. Burtt, Secretary, Ohio State University, Columbus, Ohio.
Pennsylvania: Dr. Clarence E. Ferree, Bryn Mawr, Pa.

The National Institute of Industrial Psychology.—In Great Britain an association for scientific research was incorporated on Feb. 11, 1921, under the title of The National Institute of Industrial Psychology. It has had support from well-known business men and the Carnegie United Kingdom Trust. Fees are charged for investigations likely to result in the immediate advantage of the firm. These fees are used for the salaries of the investigators and to cover overhead expenses.

Professor Charles S. Myers, M.D., D.Sc., F.R.S. has the direction of this work. The central offices at 329 High Holborn, London, W.C. 1, are in charge of the secretary of the Institute, Dr. G. H. Miles.

Other Foreign Sources.—Drs. C. Piorkowski and W. Moede, Luitpoldstrasse 14, Berlin, W. 30, Germany, have charge of an institute with headquarters at the Technische Hochschule. They publish a journal, *Praktische Psykologie.*

An *Institut d'Orientalió Professional* at Saint Honorat No. 5, Barcelona, Spain, is under the direction of Sr. Ruiz Castella.

In Switzerland the *Institute J. J. Rousseau* at Geneva under the direction of M. Pierre Bovet has engaged in work in industrial psychology.

In the orient Dr. Yoichi Vyeno is Director of the *Institute of Industrial Psychology* at Tokyo, Japan.

M. J. M. Lahy, 12 Rue Linné, Paris, secretary of the Second International Conference of Industrial Psychology, and the *Société d'encouragement au Commerce et a l'Industrie* at 4 Rue de Rennes, Paris, are the chief French sources.

THE NATURE OF INDUSTRIAL PSYCHOLOGY

What Industrial Psychology Is.—But this is not telling what industrial psychology is. It is the application of the methods of science to the human side of industry. It does not become psychological because the scientific method is used. It is psychological because meters and construction are not observed, but artisans and laborers are studied. It is not psychological if one reasons about the things relating to the human side of industry, if he asks others for their opinions, if meetings are attended, or if philosophies of human conduct are perused. It becomes psychological when one gathers trustworthy data, studies it with the aid of adding machine and slide rule, and finally reaches some practical decision that is scientifically sound and mathematically justified. Whenever the human problems of industry are approached in this fashion, one may say that here is an example of industrial psychology.

In some minds psychology means tests: Asking an individual if Mozart was a violin player or a race horse; if a revenue cutter is used on a milling machine or a lathe; or if Anatole France is a summer resort, a state, or a man. Tests are a part of psychology, a fairly recent member of the family circle, but by no means synonymous with psychology although a popular branch at present.

It was said that the application of the scientific method to the human problems of modern economic structures was economic, or industrial psychology. Thus we must find out what the scientific methods are before industrial psychology becomes crystallized.

A science is "an exact and systematic statement of knowledge concerning some subject or group of subjects." It is knowledge that is gained and verified by exact observation and correct

thinking. The method by which this knowledge is gained is the scientific method. The aim of the scientific method is to increase the sum total of our knowledge and to increase its trustworthiness. Karl Pearson has said: "It is not facts themselves which make science, but the method by which they are dealt with." All sciences are unified by their method, however widely apart their subject matter may be. This method is the impartial, precise observation of phenomena, and their interpretation according to the commonly accepted laws of logic.

Dr. Edward L. Thorndike writes:

> Science knows or should know no favorites, and cares for nothing in its conclusions but their truth. Opinion is often misled by the "unconscious logic of its hopes and fears," by prepossessions for or against this or that book or method or result. Science pays no heed to anything but the facts it has already made sure of; it puts nothing in the scales but objective evidence. Opinion trusts its personal impressions, bows to authority and the crowd. Anyone's opinion constantly favors the methods he is used to and is suspicious of new ideas except his own; it accepts without verification and rejects without a fair trial. Science seeks precise quantitative measures of facts by which changes and correspondences may be properly weighed; opinion is content to guess at amounts of difference and likeness, to talk in the vague terms of more or less, much and little, to rate a method as better or worse without taking the pains to find out just how much better or worse it is. Science reveals the sources of its evidence and the course of its arguments; so that any properly equipped thinker can verify for himself the facts asserted to be true. Opinion offers itself to be accepted or rejected, but not to be verified or intelligently criticized. Science is the work of minds specialized to search after truth and selected as fit for the work by their equals and superiors in it. Opinion is the occasional thought of those who, though important and capable people, are yet only amateurs in the work of getting truth.

How much of current employment practice is scientifically founded? Very, very little. How much of it is founded on opinion? Almost all of it. This book will have accomplished one of its purposes if it points out the way and stimulates activity along this way towards increasing our "exact and systematic" knowledge concerning the selection of men.

But even one who aspires to be scientific cannot escape his opinions. It is the author's opinion that the following qualifications for an employment manager, which have been decided upon

by employment managers and widely circulated, completely overlook the most important factor:

	Per Cent
Personality	35
General industrial experience	25
Executive experience	20
Shop experience (for employment managers in manufacturing establishments)	15
Experience with organized social movements	5
Total	100

The missing factor—one of the "missing links" of industrial evolution—is scientific training, which includes acumen, rigorousness, and enthusiasm. It should be given a weight of at least 75 per cent. If everything that is needed were known about employment—if one out of a thousand things that should be known was known—perhaps a weight of 50 per cent would suffice. But as it is, an exact and systematized knowledge of selecting men is still in the making, if not still to be made, and selection will remain a grab bag procedure until employment managers are largely supplanted by scientific investigators of employment problems.

CHAPTER II

THE FIELD AND FUNCTIONS OF EMPLOYMENT PSYCHOLOGY

Psychology deals with the behavior of animals, whether that behavior is learning, working, fighting, sleeping, or what is commonly called, thinking. All this may, and indeed has been, studied in the lower animals, but economic psychology is primarily interested in the behavior of human beings in industry. Human behavior may be described, explained or governed. The general field of psychology includes these three approaches to the study.

Economic psychology is primarily interested in the control of behavior or the application of the general knowledge of human behavior to the field of business. Economic theories rest largely upon general psychological concepts; practical economic advancement—aside from that due to mechanical improvements—rests, to a considerable extent, upon the improved capitalization of the knowledge gained from the study of human behavior. The utilization of psychological knowledge in an attempt to understand better the economic laws and organizations largely *in the abstract*, or what should be called general economic psychology, thus needs to be distinguished from the utilization of psychology in the operation of particular economic units such as a store or a factory. This latter may be called applied economic psychology.

PSYCHOLOGY IN THE INDUSTRIAL CYCLE

Four distinct phases of the utilization of psychology in the advancement of particular economic units are to be noted. They may be considered in the order of their occurrence in the industrial cycle. First to be distinguished is the utilization of psychological methods and knowledge in the selection of employees. This is *employment psychology*. Its aim is to furnish psychological laws that make possible the selection of workers, especially fitted by their natures, for each particular type of work.

FIG. 1.—The functions of psychology in modern industrial organization.

It substitutes a fairly rigorous scientific procedure in place of the usual haphazard, common-sense procedure of the past.

After the employee has once been placed at the work for which his particular capacities and abilities have shown him to be best qualified, employment psychology, as such, ceases to function. Then the question arises of securing his maximum of effort and cooperation. He is now to be provided with incentives to use his capacities to the limit. The study and application of these stimuli is known as the *psychology of management.* Sometimes the phrase "psychology of management" is used to cover the entire field of industrial psychology. Within the strict connotation of the phrase, however, it should be limited to the handling of workers, or to factory or plant morale. Employment psychology picks workers with capacities for various types of occupations, but it is the task of management psychology to see that these capacities are realized in the actual work of industry.

The third division of applied economic psychology is concerned with the methods of working. Hours of work, the distribution of rest periods, the elimination of useless movements, the reduction of fatigue, the proper rotation and alternation of tasks fall in this division which is most fittingly termed the *psychology of work.* Many spectacular discoveries have been chronicled in the study of the organism at work and there is a respectable amount of rule-of-thumb procedure, well established in this branch of applied economic psychology, by the use of which industrial plants can greatly increase their output.

The aim of the psychology of work is to increase the output per man per hour without producing a parallel increase in fatigue. That is why it is sometimes called the psychology of efficiency, but "psychology of work" is the better term. It should be borne in mind that this applies equally to both mental and physical work, as these are commonly differentiated.

To complete the industrial cycle, there remains the *psychology of advertising and selling.* Having selected the most capable workmen by employment psychology, and having secured a maximum of effort and cooperation by management psychology, under the most favorable working conditions, there still remains the sale and distribution of the finished product.

THE FUNCTIONS OF EMPLOYMENT PSYCHOLOGY

Since this book deals almost exclusively with the application of psychology to the first phase of the industrial cycle, the dis-

cussion will now become less general and will take up in particular the employment of psychology in the selection of workers. The goal of employment psychology is *to measure* rather than to guess at the abilities of applicants for different kinds of work. That this can be done with surprising accuracy will be taken for granted at present, although later portions of the book will give ample evidence that this conclusion is justified by results. Aside from this highly increased accuracy in selecting employees, the functions of employment psychology are no different from the functions of any farsighted employment policy. But the methods of employment psychology make it possible to approach more directly some functions that older employment methods could attack only circuitously, if they were approached at all.

1. Selection of Candidates.—The obvious task that faces every employer is the selection of candidates who are endowed with a sufficient amount of those abilities essential to that occupation. Different occupations demand different abilities, and these abilities are possessed in varying degrees by the applicants. It is the first duty of applied psychology to *see that the workers have abilities adequate for the task to which they will be assigned.* If they do not, the plant will be overmanned as most plants are. That these abilities are oftentimes lacking is commonly observed.

Take the following case as an example. During a vacation period, a college student secured employment in a railroad yard. Without previous experience, he was put to work as a "boomer fireman" whose duty is to keep a head of steam in the locomotives standing idle on the tracks so that they will be in readiness for service whenever needed. It was customary to have each boomer fireman work *several* shifts as a student under the direction of an experienced man before being given the responsibility for keeping up the steam alone. This college student was given only one shift of instruction and succeeded very well in the work. Another applicant who reported for duty at the same time was unable to master the work after a week of instruction and was transferred to other work. He had lacked the ability for this apparently simple task. If there had been some way of knowing in advance that this man was deficient in this particular ability, the week's wasted instruction could have been saved and utilized to better advantage.

Employment psychology aims to give just this information in advance. It is able to do so accurately in many lines of work.

Dr. V. A. C. Henmon gives the following as illustrative of several things, one of which is the predictive value of employment psychology in so complicated a skill as flying and, at times, the utter failure of common sense in picking successful material from the ranks of flight candidates.

. . . In spite of the Examining Boards and Physical Examining Units which eliminated 50 to 60 per cent of applicants, and in spite of Ground Schools which eliminated 15 per cent of the remainder, there were still at least 6 per cent of men who reached flying fields who were discharged or transferred because of inaptitude for flying! . . . Over and above the 6 per cent who failed completely, there are a considerable number, who, while ultimately commissioned, have little aptitude for flying, learn with difficulty, and smash ships. For example, there were two men who were rated as very poor in flying and who did very poorly in the tests. One took 106 hours for his Reserve Military Aviator when the average time was well below 50 hours, and the other took 94 hours. These men were commissioned because it seemed better to use them than to discharge them and train others at great cost in their stead. The seventy-four men discharged wasted 1,400 hours of flying. Some statistician has figured the total cost of flying training as $2 per minute in the air. Whether this included the cost of wrecked ships is not known, but this group wrecked not less than thirty ships. One man, for example, was given 55 hours of flying instruction and wrecked five ships before he was relieved as "unadaptable for further training."

After some experimentation, Dr. Henmon and his associates found tests that were able to predict, satisfactorily, the candidates' flying capacity. Dr. Henmon says:

". . . the tests were given to fifty cadets of unknown ability who had just reached the field. Some of these had had no experience in flying and none over 2 or 3 hours of dual instruction. On the basis of performance in the tests, solely, I submitted to the officer in charge of flying a prediction that five of these men would either be discharged or learn to fly with great difficulty. Two others were selected as showing special aptitude, one of whom, because of deficiency in formal education, had difficulty in getting into the service. Of the five men, three were discharged after 4, 20, and 22 hours of instruction, respectively. One of these men wrecked two ships completely. The fourth man was relieved from flying at one time and brought before the Discharge Board, but was given another chance and finally commissioned after 85 hours of flying instruction when the median time for his class was 60 hours."

2. Eliminating Inefficient Employees.—The converse of choosing employees with abilities adequate to the occupation in which

they will be placed is the *elimination in slack seasons of the workers whose abilities are lowest.* In the case of linotype operators, the best men set twice as much type as the poorest men. Where the rate of pay is by the hour, two low men can be given leave and the production will be decreased no more than if one of the best men had been given leave. Every industrial enterprise suffers a drain from workers who are distinctly less productive than others. This drain is often concealed when records of individual production are not kept. It may be discovered by production records or by properly validated employment tests.

3. Placing According to Ability.—The extreme opposite of too little ability is *too much ability.* At first this conception may appear somewhat absurd. But return to the illustration of the college student serving as a boomer fireman. He had the ability to do that particular work without approaching the limit of his capacities. While he made a successful fireman, he could have succeeded equally well in more difficult tasks for which there is a shortage of suitable workers. Emerson said, "That man is idle who can do something better." This man was idle. He would have served his employer more valuably and himself better if he had been placed at work which necessitated the use of his superior abilities.

The economic loss due to incapable workers is an *actual loss* that no one can deny; the loss due to the policy of employing big men in small jobs, or men using only a fraction of their abilities, is a *potential* loss, but none the less real. Both types of loss can be eliminated in an economic Utopia; both have traditionally been accepted as inevitable. These two losses do not cancel each other. Rather are they supplementary.

A surplus of labor supply does not justify the displacement of workers above or below their abilities. The loss due to workers below par is apparent first, for there is salary paid in addition to overhead and spoiled work. The worker placed below his abilities could be used to decrease overhead in the more expensive operations, in which greater skill and capacity are needed, by displacing the less competent workers in the higher level.

How great the misplacement below maximum capacities is may be made clear in a few statements of fact. At a printing and binding establishment, the working force was reduced from between 800 and 900 to approximately 500. The employment

manager said: "This change took place over a period of 3 years and was not brought about by discharging. When an employee left, he was not replaced by hiring a new worker, but by transferring from within."

4. Advantages of Psychology in Selecting Apprentices.—In the *selection of apprentices* employment psychology can be used to advantage as well as in the selection of apparently trained workers. If prospective linotype apprentices could be accurately gaged before taking up this work, the men who set only 2,500 ems after years of practice could be warned away and directed into occupations for which they show greater capacities. As it will be shown later, in the study of individual differences, that they are not eradicated or greatly altered by training, it is fair to assume that the proper time for employment selection in most occupations is in the apprentice stage Usually, the apprentice enters upon a given trade accidentally and blindly. He follows in his father's footsteps, takes the first opportunity that presents itself, or is captivated by his imagination and seeks some alleged romantic pursuit such as is generally connected with military and naval life.

By ideal psychological methods, the inefficient bookkeeper or clerk of forty would have been detected at eighteen; the incompetent mechanic could have been directed into more suitable work at fourteen, and so on through the array of misfits who are too small for their industrial clothing. The clerk who would have made a very successful and valuable salesman is a misfit, but he is too big for his industrial clothes. So is the mechanic who would have been of more social and economic value as a mechanical engineer. These individuals should have been directed into the higher pursuits just as their weaker brethren should have been cautioned before they entered a place in industry for which they were not adapted.

The time to deal with misfits is before they have had a chance to follow up their vocational intentions. The usual plant is helpless in this particular, to a considerable extent, except in the selection of apprentices. The proper place to start this work is in the early grades of the public schools.

5. Psychology as an Aid in Settling Labor Disputes and Internal Plant Troubles.—Labor disputes and internal plant troubles may be settled by the methods and instruments of employment psychology. Cases that were discovered in time

and settled by common sense are not rare. John M. Williams, while president of the Philadelphia Association for the Discussion of Employment Problems, gave the following instance:

We have one young man of undoubted ability, good personality pleasant, and obliging. He became a regular Monday absentee, took all that was said to him as a reprimand with a lackadaisical air, and had evidently lost his "pep." We found upon investigation that he was fast becoming disgusted with his outlook and felt that he was up against a blank wall. We transferred him to a semi-executive position in another department, gave him larger responsibilities and a larger salary, and he has more than made good.

This was a case of the work not recognizing the capacities of the worker. Undoubtedly, many plant faultfinders are men whose jobs are too easy for them. Simple replacement to the proper level oftentimes changes a slovenly worker into a careful one and replaces apathy and disgust with zeal and interest.

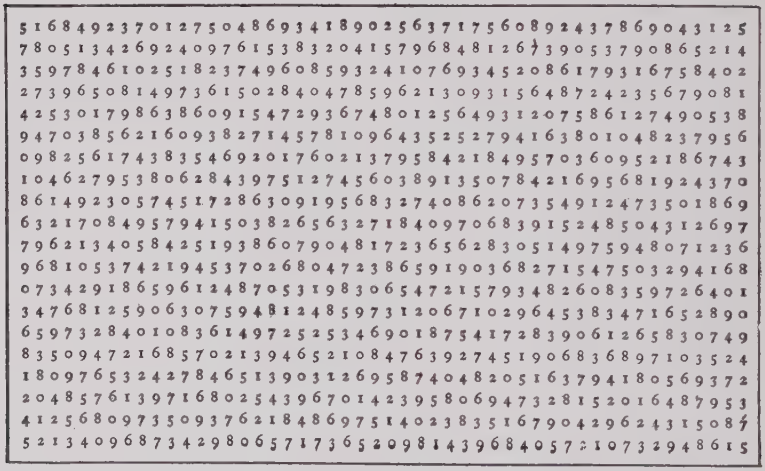


FIG. 2.—The *cancellation test* used by Dr. Link. The person being tested crosses out each 7 as rapidly as he can while the time is noted in seconds.

Another example of the need for internal shifts of workers, but in this instance the employees had been placed above their abilities, is given by Dr. Henry C. Link. This is especially illuminating since the methods of employment psychology were used to readjust the workers to their industry.

In a small arms plant, some eighty girls employed at inspecting bullets were complaining of the low piecework rate of pay. It was difficult for the foreman to retain the inspectors although the

rate was higher than paid elsewhere for the same work and bullet inspectors in other plants were contented with the prevailing scale of wages. Both claims were well founded; the eighty inspectors were earning small wages and yet they were paid at a high rate, the highest, in fact, ever paid for that work.

From an assortment of tests previously given to other inspectors, Dr. Link had found that the completion of two tests in particular was associated with success in the work under discussion.

983642	168379	694517	253914	745682	158923	729648
426357	372159	754936	297835	627519	786531	731469
654173	947386	589761	134852	146237	194526	936425
837162	691324	814536	326175	368792	549826	572194
458671	971648	479612	495683	784295	817243	916328
275148	318495	635728	596873	982563	431289	381647
513978	182765	615832	851279	498136	356719	412789
197584	563792	748315	861395	421856	973124	125437
918654	846975	453867	281463	213956	651274	526987
397841	961872	248691	574389	532416	723964	473519
872351	327984	437528	864712	825916	682543	534169
923871	632791	765429	235849	672834	295481	349257
867314	462758	486592	198537	871596	164985	247153
963458	981374	156843	259671	762491	983567	579361
345962	941258	182653	561487	435781	179428	731825
672389	346521	427163	281937	672539	985273	956142
312876	853926	587436	296851	784623	875126	513647
934612	739548	843216	215367	916483	294378	768914
954178	371629	529817	436978	123874	957641	682917
719325	294736	639187	286415	593182	297568	145389
594231	389254	196235	825749	461289	378652	672841
349716	427395	138962	268794	524617	358472	319546
714932	759431	382145	853624	714529	635819	237465
649752	718254	596743	862934	851763	329418	495867

FIG. 3.—The *number group checking test* used by Dr. Link. The person being tested is to check each group of numbers containing both 7 and 1 while time is kept by a stop watch.

These two tests required about 10 minutes to give. The dissatisfied workers were tested at their benches. The following data show what was found:

	Average score in the number group checking test	Average score in the cancellation test
Complaining inspectors	191	139
Other inspectors	176	135

Since in the tests a high score signifies inefficiency, these data indicate that the complaining inspectors lacked the abilities requisite for this work. The number group checking test was the one that had been previously found to be the best single indicator of proficiency, and it was in this test that the scores of the complaining group were farthest below the other inspectors.

This showed clearly that the cause for the complaint lay in the fact that these inspectors were not adapted to this particular work rather than that the rate of pay was low. If these tests had been used in selecting inspectors in the employment office, the poorly qualified girls could have been shunted into work for which they were better equipped; while inspectors, qualified to do more work in the course of a shift, could have been reducing the production cost on the product. Furthermore, if these girls, who looked the same and had the same education and the same general experience as the girls better adapted for the work of inspecting, had been paid by the hour or day, their employer would have been experiencing a loss of which he would have had no record. It is in such a case as this that the need is apparent for the methods of employment psychology, both in times of labor scarcity and in periods of surplus.

6. Detecting Temperamental and Personality Handicaps.— Another function of employment psychology is in the *detection of temperamental and personality handicaps.* According to Dr. Jau Don Ball, these are "the queer guys, eccentrics, disturbers, querulous persons, unreliable and unstable fellows, the irritable, the sullen, the socially disgruntled, unsociable, negative, conscientious, litigious, bear-a-grudge, peculiar, glad-hand, gossipy, roving, restless, malicious, lying, swindling, sex pervert, false accuser, abnormal suggestibility, and mental-twist types." In this catalogue, Dr. Ball has used the everyday, vernacular phrases that are used to describe what are known technically as *psychopathic personalities.* The director of the Massachusetts Society for Mental Hygiene has said:

> Classify them as one will, the fact remains that the industrial psychopathic is a thorn in the side of every plant management. No shop is too small not to harbor at least one of them, and one who may be especially maladjusted can destroy in a week the entire morale of a plant which required years of patient effort to build.

At times these temperamental or personality handicapped employees are more amusing than serious. So we may consider the case Miss Jarrett cites of:

. . . a colored laborer who would dress up once or twice a month on Saturday in white trousers, frock coat, and silk hat, and walk up and down the main street of the works. On that day he would not report for work but otherwise was a satisfactory employee.

The case reported by Dr. Ball "of an arrogant, bellicose, 'carry-a-chip-on-the-shoulder' type of foreman who was constantly swearing and abusing his men" is not quite so humorous. This man, although a foreman and in a position of responsibility, was estimated to have a mental age of not over twelve years. Added to this handicap were the temperamental disqualifications just described. His present position had been obtained as a reward for many years of service. In a 3-months' period, studied by Edward Williams of Berkeley, California, this foreman had a turnover of 416 per cent. Of the men who quit, 27 per cent quit because of disagreements with the foreman. With the cost of breaking in employees in this industry at $40, in 3 months the cost of this turnover amounted to $3,880 or considerably more than the yearly salary of the foreman.

Another case belonging in this section is reported by Margaret J. Powers:

. . . a stenographer about forty years of age. The case was first referred in Sept., 1918, by the Liberty Loan Committee who had been obliged to discharge her because of difficulties she had encountered with the other employees. She is a small, spare woman with nervous motions, and is quick at taking offense. She has a tendency to be jealous of other employees and to think that she is not fairly treated. She is always straightening out paper and arranging and rearranging things to suit herself. Although she is a first-class stenographer and typist, she seems unable to adjust herself to any environment.

In 3 years this woman had held twenty-five positions; the longest tenure was 1 month and the shortest 2 days. She was industrially handicapped and a handicap to industry, not because of a lack of proficiency as a stenographer and typist but rather because she labored under temperamental and personality disadvantages.

The economic cost of this class of workers, which is of immediate concern to the employers, need not be conjectured since there are records of the actual cost in some instances. An example of this may be found in the case of a man whose industrial record over a period of 9 years was studied. He was a psychopathic personality who had held 123 jobs in this time. He had been employed by 103 different firms and had worked at

33 distinct occupations. His longest job had lasted 8 months, and his shortest, 1 day. He had been fired eighty times, had quit twenty of the jobs, and nineteen of them had been of a temporary nature. Most of his work was in a capacity involving semi-skilled trade abilities where proficiency is usually reached after a few months' experience. The economic cost of this man was estimated as follows:

Cost of hiring	$ 47.50
Cost of training	960.00
Wear and tear	392.00
Reduced production	1,879.00
Spoiled work	330.00
Total	$3,608.50

The actual wages paid to the man for these 123 jobs had been $3,316.21.

This individual is a rather extreme case, but he has many close mental relatives in industries everywhere. Some of these come near to the borderline where it is difficult to separate the normal from the pathological. Many others are easily recognized by the trained observer. Miss Jarrett, who has done survey work in this field for the Engineering Foundation, estimates that 50 per cent of the workers in industry are working under temperamental or personality handicaps.

It is extremely difficult to detect these defects by traditional employment methods and, as yet, there are no psychological tests comparable in accuracy to those tests for stenographers, or test of intelligence, that can unerringly ferret out these unhealthy personalities.[1] There are some that are useful, however, and these will be given mention later.

SOCIAL IMPLICATIONS

It is beyond the direct province of employment psychology to take up the ethical bearings of employment. It is not amiss, however, to point out the personal and social value of work of this kind for the individual worker, as well as the economic gain to industry itself. To take up the functions of employment psychology in the reverse of the order in which they have been presented, we will start with the temperamentally disqualified

[1] Since this was written the Colgate Mental Hygiene Test has been issued and is in use in many places.

worker. Has employment psychology completely discharged its obligation when the applicant, who deviates from the normal in personality, is rejected, or when, in slack seasons, those already in the firm with similar traits are weeded out? Emphatically no! This is but shifting the burden to other firms or to society. It is further aggravating an already irritable mental condition that responds to a degree often out of all proportion to the intensity of the situation.

Abilities for various occupations are largely inborn and beyond the power of man to change. These temperamental defects, on the other hand, are largely acquired and amenable to proper care. It is this fact which broadens the obligations of the employment psychologist who should be trained in psychiatry and mental hygiene as well as in mental measurements and scientific methods. To fulfil adequately the functions of employment psychology, it thus becomes desirable for the one who selects and reclassifies workers to know more psychology than is needed merely to apply the rule-of-thumb methods of selecting workers with different capacities. The plant physician, too, should be qualified in psychiatry and mental hygiene, as he is in sanitation and emergency surgery, so that he can minister to the mental functions of the workers as well as to their sore thumbs and dusty lungs.

In respect to the selection of workers for specific tasks, it should be stated that the situation is different. Abilities are largely inborn and can be altered but little. If an applicant for the position of stenographer is found by test not to have the abilities for this work, a mere refusal of employment is only a social compromise. She should be frankly told that her training for this work has been wasted, that she will never even be an average stenographer, and that, instead of continuing in search of employment in this capacity, she should enter into the work for which she seems to be better fitted by the battery of tests she has taken. Rejection thus becomes at once vocational counsel. It is easy to give this sort of counsel to the apprentice, but how about the applicant who has been trudging along as an inferior worker in his or her trade or occupation for years?

Age, maturity, and experience or training do not alter the fundamental duties of the employment manager. It may be harder to tell a man several years one's senior and with years of trade-training that, from the beginning of his apprenticeship,

he has been in an occupation for which he was poorly qualified, except by interest. But it is difficult to see how this case is fundamentally different from that of the worker who was contemplating embarking on the wrong career.

Employment psychology can be made something more than a somewhat selfish selection of the best, raw, working materials; it can be turned to important, humanistic services.

ARE IMPROVED METHODS OF SELECTION NEEDED?

One is not justified in assuming that, since psychology is young, vigorous, and misunderstood, industry is in dire need of any succor this newcomer can force upon it. There are, however, several lines of evidence which unmistakably point to the conclusion that traditional employment methods have failed to serve industry well.

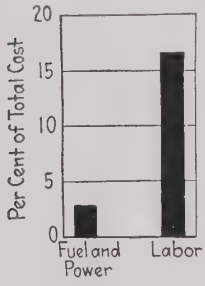


FIG. 4.—Labor costs are five times greater than the cost of fuel and power—yet which receives the greater engineering attention.

Employment is concerned with the life blood of the plant. This blood is expensive, both from the approach of competition and the price the public pays. Twenty-two and one-half per cent of the value of the finished products of the iron and steel industry represents the cost of labor. The employment officials are responsible for keeping this cost at a minimum. In the same industries, the engineering departments are responsible for the efficient administration of only 5.7 per cent of the final cost in the form of fuel and power. In Fig. 4, is charted the contrast between these two items for a large number of unselected industries.

This pertinent question arises from a study of the data: Is the cost of power and fuel *naturally* one-seventh that of labor, or has it been reduced to this fraction by diligent, skilled engineering effort? In other words, if as much attention and experimental expense were directed to employment, as there has been to engineering, and toward the reduction of power and fuel costs, is it not likely that the labor cost would be diminished? It is a mockery of "modern industrial progress" to admit that this has not been attempted.

EMPLOYMENT PSYCHOLOGY IN RELATION TO TURNOVER

Labor turnover is one of the chief banes of modern industrial existence. Magnus W. Alexander of the General Electric

Company[1] reports a survey of the cost due to this factor in twelve plants in the year, 1912. These data may seem anti-

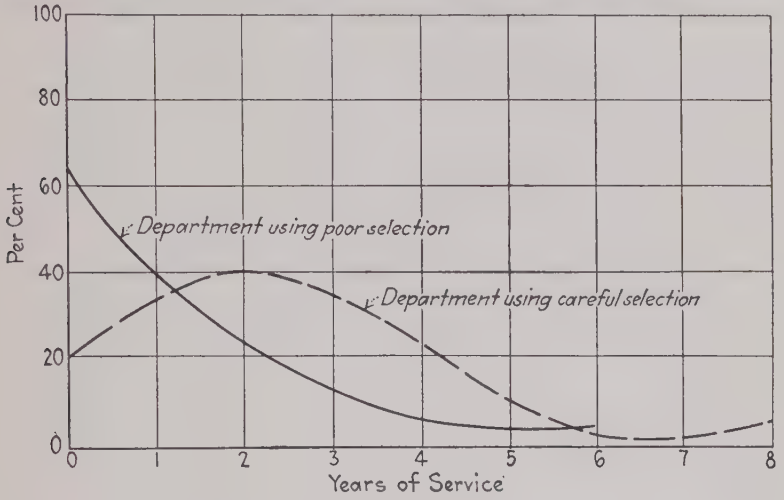


FIG. 5.—Poor employment methods are accompanied by short service in this firm. (*Data from Dr. M. A. Bills.*)

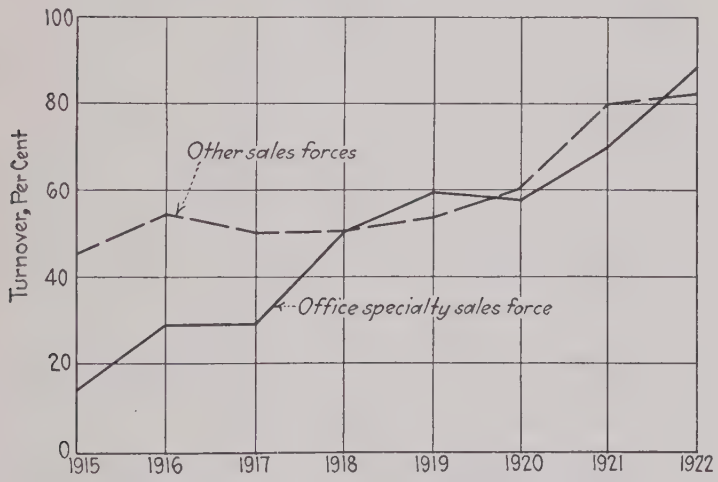


FIG. 6.—Turnover in many cases is increasing rather than decreasing. (*Data from William E. Lange.*)

quated, but 1912 represents a normal, economic year while more recent figures would be for abnormal periods. The annual

[1] *U. S. Bureau of Labor Statistics, Bull.* 227.

payroll of the plants studied was $29,000,000 and the waste due to labor turnover was approximately $1,000,000 or 3½ per cent of the payroll. Mr. Alexander says:

> If the experience of the twelve factories was assumed to be typical of all manufacturing industries of the country, the national economic loss from hiring and firing employees would amount to approximately $172,000,000 annually, based upon the number of employees; $187,000,000 based on capitalization; and $248,000,000 based on total sales.

So much for the expense estimated to industry from turnover. The rate of turnover itself varies enormously. In exceptional plants it may be as low as 20 per cent yearly of the men on the force; in other plants, it may reach as high as 8,000 per cent. The majority of plants experience a turnover rate of about 80 per cent.

A high rate of turnover is not a necessary evil though it is very prevalent. The experience of the Ford Motor Company reveals a remedy in this connection, as shown by the following tabulation:

Year	Average force employed	Total leaving	Turnover rate, per cent
1913	13,623	50,448	370
1914	12,115	6,508	54
1915	18,028	2,931	16
1916	32,888	7,512	23

The reduction of the turnover from 370 to 54 per cent was largely due to the introduction of a shorter day and higher wages on Jan. 1, 1914.

In studying methods of reducing turnover, it is impossible to separate employment from management psychology; in fact, it is oftentimes a question if it does not result from an ignorance of the latter. But employment psychology plays a rôle that cannot be overlooked. The data of Fig. 7 show unquestionably that turnover is greatest among new employees. Why is this? Why is it that in twelve industries 68.2 per cent of the men who leave have been employed less than a year? Limiting the discussion to the employment phases entirely—although recognizing the influence of management as indicated above—a review may be made of some additional data bearing directly on this question.

Discharges in seventy-eight establishments studied by the United States Commission on Industrial Relations constituted 11.9 per cent of the terminations of employment. In one plant, over 50 per cent of the turnover was due to discharges; in other plants, discharges constituted less than 5 per cent of the total

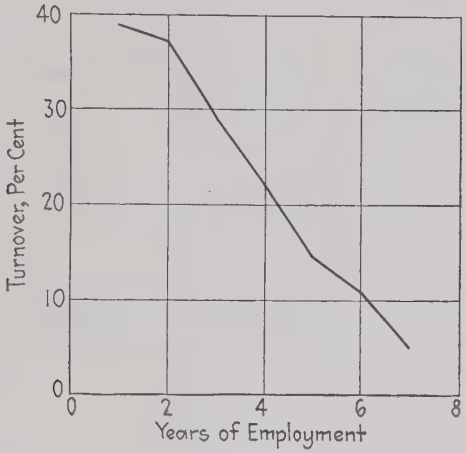


FIG. 7.—The high turnover among new employes suggests that they have not been properly selected. (*Data from Dr. Sumner H. Slichter.*)

turnover. The distribution of discharges to total turnover in these plants is shown in the following tabulation:

Percentage of discharges to total turnover	Number of plants in which discharges were the specified percentage of total turnover	Per cent of all plants
Less than 5	21	26.9
5 to 10	14	17.9
10 to 15	16	20.5
15 to 20	13	16.7
20 to 25	5	6.4
25 to 30	5	6.4
30 to 40	1	1.3
40 to 50	2	2.6
50 and over	1	1.3
Totals	78	100.0

An average of approximately 12 per cent of turnover being due to discharges may seem like a small amount but, when this is changed into 12 per cent of the loss to industry due to turnover, it becomes (see page 28) $29,760,000 based on total sales.

The reasons for the discharges can now be taken up, searching especially for indications of faulty hiring rather than of hasty firing. The following data show the per cent of discharges due to unadaptability in the plants indicated for the given years. Unadaptability includes those who proved incompetent, slow, or physically unfit and those who had an unusual amount of spoiled work.

DISCHARGES DUE TO UNADAPTABILITY
(Percentages)

Kind of plant	Year					
	1911	1912	1913	1914	1915	1916
Metal-working	....	....	30.9	27.8	30.7	20.8
Metal-working	....	....	....	....	29.6	
Metal-working	....	....	46.2	51.2	59.0	48.9
Printing and binding	....	31.8	35.0	39.1	40.0	
Shoe	45.0					
Silk	....	....	....	....	7.2	
Store	....	....	....	....	46.4	66.7

If the above percentages are averaged, which is justified for present purposes, it is found that 39.2 per cent of discharges were due to employees being placed in work for which they did not have abilities. This percentage represents only those discharged for gross inability to do the work. It does not include those slightly but significantly below the average in skill or production. Reasons given for discharge are not always reliable, but the approximate accuracy of the data may be assumed. It is apparent that, if the workers had been placed in the work for which they were best equipped, there would not have been this loss due to unadaptability.

Experienced as well as inexperienced workers are misplaced above their abilities, to a remarkable degree, by traditional employment methods. The following data from a Chicago metal-working plant which show the per cent of discharges due to unadaptability for the work by men and boys are pertinent in this connection:

DISCHARGES DUE TO UNADAPTABILITY
(Percentages)

	Year			
	1913	1914	1915	1916
Men	29.5	39.0	30.4	17.9
Boys	29.3	33.7	32.1	25.4

The average for this 4-year period is 29.2 per cent of the older workers and 30.1 per cent of the boys, a difference that is not significant. It is significant, however, that the traditional method of employing laborers fails to select the best adapted

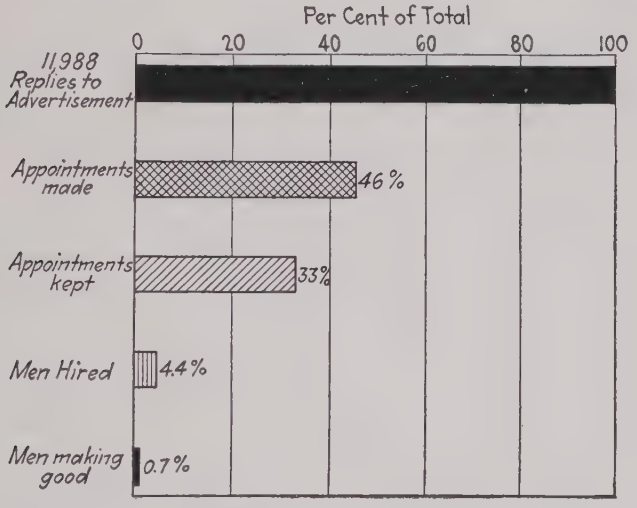


FIG. 8.—Should not more than 84 out of 11,988 men make good as salesmen? Perhaps something was wrong in the way they were hired. (*Data from O. R. Johnson.*)

workers about equally among both experienced and inexperienced workers. Ideal employment methods should avoid this source of turnover.

Another third of the discharges of workers is due to what is termed shiftlessness or unreliability and wrong attitudes toward the industry. This catalogue includes the habitually lazy, the unreliable, the disagreeable, the dissatisfied, the chronic "kickers," and the trouble-makers. These are clearly cases of temperamental and personality disqualifications. More than

in the case of the incompetent workers, however, these disturbers may be symptoms of poor management as well as failure in the selection of the workers. The following tabulation shows how important these trouble-makers are in turnover:

DISCHARGES DUE TO SHIFTLESSNESS AND WRONG ATTITUDE
(Percentages)

Kind of plant	Year					
	1911	1912	1913	1914	1915	1916
Metal-working	....	....	34.5	26.2	35.1	32.8
Metal-working	....	....	....	....	15.9	
Metal-working	....	....	32.3	28.8	24.6	33.3
Printing and binding	....	15.9	15.0	17.4	25.0	
Shoe	27.7					
Silk	....	....	....	....	34.9	
Store	....	....	....	....	24.4	10.2

These temperamental handicaps are neither peculiar to older workers nor are they detected better in youth than in age as the following data from a Chicago metal-working plant show:

	1913	1914	1915	1916
Men	33.9	24.4	35.4	28.2
Boys	38.8	28.9	32.1	41.1

The greatest single causes of resignations are: More attractive opportunities and dissatisfaction with the present work. These account for over half of the resignations. A better job may mean that the wages of the present job are low; it may mean that the workers are handled in the wrong way; or it may mean that the present wages are low because the worker is in an occupation for which he is ill-adapted. Available statistics are such that it is impossible to evaluate them and determine just how many resignations are due to workers placed too high or too low for their abilities. But it is obvious that there should be a close connection between these evidences of misplacements.

Professor Sumner H. Slichter who has published a detailed study of, "The Turnover of Factory Labor," says:

From the standpoint of the workmen as from the standpoint of the employers, the turnover is probably more important as a symptom than as a cost in itself. It is a symptom of *inefficient hiring methods which place workmen in positions for which they are unfitted or for which they are less adapted than for other positions;* it is a symptom of severe and disagreeable work; of bad working conditions; of piece rates below a fair level; of inadequate methods of instructing workmen in the job when hired; of defective management resulting in friction, inefficiency, and open conflict; of lack of opportunity for workmen to advance on the basis of merit; of poor planning and organization of the work in individual establishments resulting in temporary jobs, an unduly high peak load, and an unduly low load; and of a lack of coordination and cooperation between industries whose slack and busy seasons dovetail.[1]

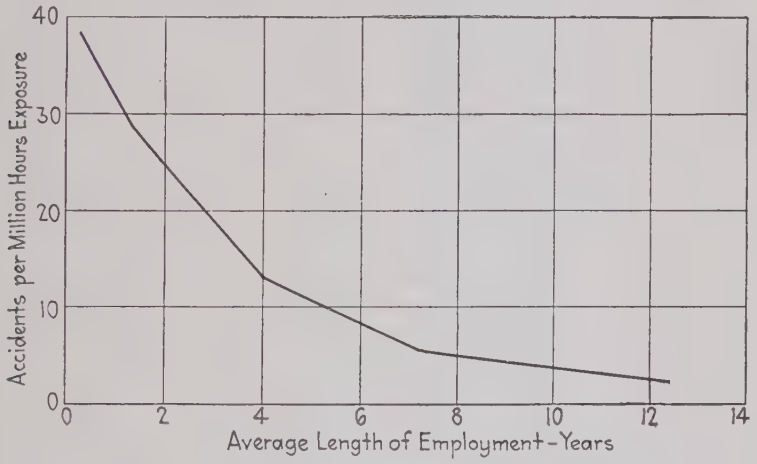


FIG. 9.—A workman of capacity should not be so bunglesome as to increase the accident rate, still accidents are greatest among new workers.

That there is a further need for employment psychology among young applicants is evidenced by data recently gathered by Dr. Gustave A. Feingold at Hartford, Conn. Dr. Feingold studied 512 high school freshmen but, for the present, we are concerned only with his findings in the case of 250 of the boys from this class. The mental ratings of these boys in general intelligence had been determined by tests. Records were gathered of the occupational choices of these same boys and the mental rating necessary for successful mastery of this occupation was determined from a table of existing data that is in vocational use and

[1] Page 159. Italics are ours.

is experimentally based upon the actual intelligence found necessary for the different vocations.[1] When this was done, it appeared that these boys had chosen industrial clothes several sizes too large for them. This fact is shown by the accompanying diagram (Fig. 10). In this we find that 48.0 per cent of these boys had set their hopes upon occupations that required more intelligence than they possessed. In contrast with these, there were only 8.8 per cent who had selected occupations requiring less intelligence than they had. Less than half, or 43.2 per cent,

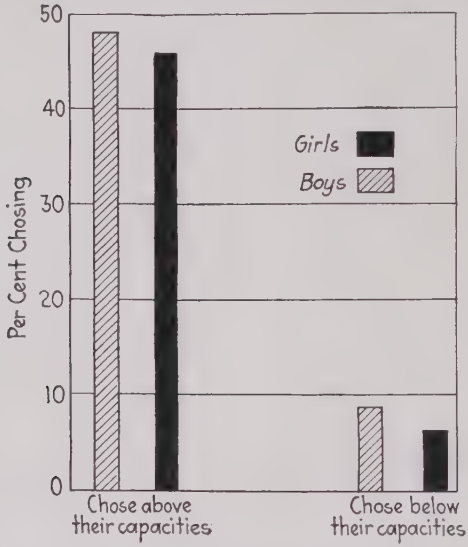


FIG. 10.—Unguided youth cannot be taken into industry as their wishes prompt them. These bars show the tendency for about half to enter work too difficult for their capacities, while scarcely 10 per cent would enter work below their capacities. (*Data from Dr. Gustave A. Feingold.*)

had of their own choice hit upon an occupation that was at their level of possible achievement. The 8.8 per cent, if they had been able to follow out their ambitions, would have been a potential loss—the workers whose industrial clothes are too small. The largest portion, the 48.0 per cent, if their desires had not been crossed or altered, would have been the sources of actual loss —the workers whose industrial clothing is too large.

Dr. Feingold notes the following astonishing findings:

There is a conspicuous tendency for the superior pupils, those of A and B mentality, to underrate their ability and choose a profession

[1] Further explanations of this will be found in Chap. IV.

that falls in a mental level considerably below their own. And there is a still greater tendency for pupils of low mentality to choose professions that lie considerably above their mental levels . . . the lower an individual stands in mentality, the higher seems to be his vocational ambition.

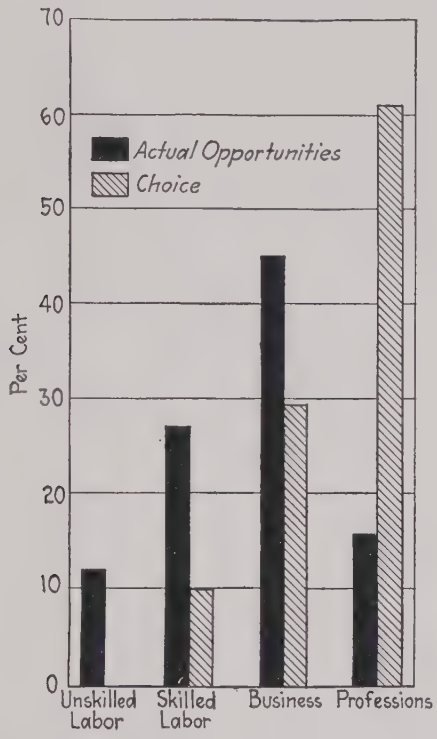


FIG. 11.—This shows the tendency for youth to set its mind on work out of proportion to the opportunities in the community. (*Data from Dr. I. N. Madsen.*)

Except for minor and insignificant differences, the girls showed the same disparity between capacity for an occupation and the occupation chosen.

These data show how the newcomers will enter industry unless they are properly detected at the plant gates. That workers are usually more ambitious than capable is a safe, working axiom. That many are placed in industry according to their ambitions, rather than their capabilities, will be evident as we proceed in the following chapter.

SUGGESTED READINGS

At the end of some of the chapters references are given for additional reading. One engaging in actual employment psychological work should have an intimate knowledge of these. No references are given to periodicals since they are too difficult to secure. For the benefit of those who desire to use periodicals also, a list is given below. If periodicals are used, complete files should be available.

Books

Burtt, Harold E.: "Employment Psychology," 568 pp., Houghton Mifflin Company, 1926.

Cowdrick, E. S.: "Manpower in Industry," 388 pp., Henry Holt & Company, 1924.

Edie, L. D.: "Principles of the New Economics," 525 pp., Thomas Y. Crowell & Company, 1922.

Gilbreth, F. B. and L. M.: "Applied Motion Study," 220 pp., Sturgis & Walton, 1917.

Gilbreth, F. B. and L. M.: "Fatigue Study," 159 pp., Sturgis & Walton, 1916.

Link, H. C.: "Employment Psychology," 440 pp., The Macmillan Company, 1919.

Myers, C. S.: "Mind and Work," 175 pp., G. P. Putnam's Sons, 1921.

Slichter, S. H.: "The Turnover of Factory Labor," 460 pp., D. Appleton & Company, 1919.

Snow, A. J.: "Psychology in Business Relations," 562 pp., A. W. Shaw Company, 1926.

Tead, O. and Metcalf, H. C.: "Personnel Administration: Its Principles and Practice," 2nd Edition, 543 pp., McGraw-Hill Book Company, Inc., 1926.

Journals

Archives of Psychology. Founded in 1906; edited by R. S. Woodworth. Published irregularly. Address: Archives of Psychology, Sub-station 84, New York City. (Devoted to reports of experiments carried out at Columbia University, a large number of which are directly in the field of employment selection.)

Journal of Applied Psychology. Founded in 1917; edited by James P. Porter and William F. Book. Published quarterly. Address: Athens, Ohio.

Journal of the National Institute of Industrial Psychology. Founded in 1921. Published quarterly by the National Institute of Industrial Psychology. Address: 329 High Holborn, London, W. C. 1.

Journal of Personnel Research. Founded in 1921; edited by W. V. Bingham. Published monthly. Address: Williams & Wilkins Co., Baltimore, Md.

Praktische Psychologie. Founded 1919; edited by W. Moede and C. Piorkowski. Published monthly. Address: Berlin W. 30, Luitpoldstr. 14.

Industrial Psychology. Founded 1925; edited by Donald A. Laird. Published monthly. Address: Hamilton, N. Y. (Published for the industrial executive.)

Industrial Psychology. Founded 1926; edited by Donald A. Laird. Published monthly. Address Hamilton, New York.

CHAPTER III

THE EXTENT AND NATURE OF INDIVIDUAL DIFFERENCES

Employment selection is necessary because individual characteristics differ from man to man. If all men were alike, it would not be necessary to interview applicants until one appeared who seemed to be better adapted for the work at hand than his fellows. If all men were alike, the same period of apprenticeship in any trade would make all the workers equally capable. All machinists would be equally skilled; all linotype operators would set the same amount of material every day; and trouble-makers would be exceptional.

There is, of course, a great diversity of ability among workers. No comparison can be drawn between the president and the laborer who cannot remember what he worked on day before yesterday; nor between this laborer and the one who knows more than his foreman and gang boss. Employment engineering demands that the nature and causes of these variations be known in intimate detail. It is the purpose of this chapter to discuss their amount, kind, and nature.

In discriminating differences in pitch, Dean C. E. Seashore[1] has found that the individual with the poorest abilities in this work can scarcely distinguish the difference between two sounds separated by half a tone, while keen observers can detect a difference of only one-twentieth of a tone. From the common-sense point of view, this might indicate a difference in ability that makes the second person 200 times as capable of detecting differences in tones as the first. There are some scientific objections, however, to such an inference, and these will be taken up later. At any rate the difference, regardless of our present inability to state definitely "how many times" the one person surpasses the other, is very large.

In his study of the rapidity of movements, Dr. F. L. Wells[2] has discovered, in ten subjects observed, that the slowest could tap

[1] "The Psychology of Musical Talent," p. 60.

[2] *American Journal of Psychology*, 437 pp., 1908.

only 155.2 times in 30 seconds, while the fastest tapped 218.8 times in the same interval. If one could imagine some industrial condition in which the output of the worker was limited by his ability to tap rapidly, the faster of these two persons cited by Dr. Wells would be able to do between one-third to one-half more than the slower person.

Loveday and Munro[1] give charts showing the output of equally trained workers in certain operations involved in the manufacture of shoes. Some of their findings are presented below. The last numerals of the data given are not accurate, since these investi-

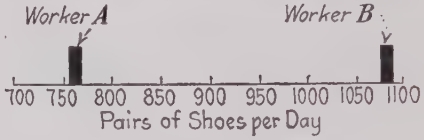


FIG. 12.—When two heel trimmers are compared individuals appear to be separated by a large gap in productivity. (*Industrial Fatigue Research Board, Report No.* 10.)

gators have charted all their data and it has been necessary to obtain the figures from the charts.

INDIVIDUAL DIFFERENCES IN SHOE MANUFACTURE

Operation	Pairs on typical day	
	Better worker	Poorer worker
Heel trimming	1,090	765
Bottom scouring	490	245
Pulling-over	285	280
Consol lasting	210	130

In terms of output per day, these figures indicate that, if ten men, with abilities equal to the better worker, were engaged in the first operation listed, the output would be 10,900 pairs. If the ten operatives were composed of five with abilities equal to the best workers and five with abilities equal to the poorest, the output with the same mechanical equipment would be reduced by 1,625 pairs of shoes per day, or more than one-tenth. As this particular plant is now manned, one worker at heel

[1] *Report of the Industrial Fatigue Research Board,* No. 10 (Great Britain).

trimming does only three-fourths as much work, in terms of the finished product, as the better worker.

To all outward appearances some of the operations listed above are limited largely by mechanical arrangements but, in spite of this semi-regulation of output, the differences are apparent. It is obvious also that over half the processes in this plant plainly depend more upon the worker than upon the machines.

Similar records of individual variations in work that is not limited by machines show the same persistent differences. The following records of two laundry workers studied by May Smith[1] indicate this clearly.

INDIVIDUAL VARIATIONS IN TIME (SECONDS) REQUIRED ON AVERAGE TO IRON ONE SHIRT

	10 to 11 a. m.	5 to 6 p. m.
Worker A	279	307
Worker B	213	217

In the morning hour reported, worker A required more than a minute longer to iron a shirt than did worker B; in the afternoon hour reported, it took her 1½ minutes longer. Using the difference of 1 minute in the course of the 9-hour day during which they were employed, worker B would have ironed approximately 150 more shirts than her less capable co-worker. In the same investigation it was found that one worker required an average of about 140 seconds to place 50 collars for steaming, another worker required about 155 seconds, another 140, another 130, another 150, while another, at the same hour of the day, required only 85 seconds for the same operation.

In a coal mine it was found that the best miners (0.57 per cent of the total workers) turned out twelve times as much coal as the poorest miners! There were 732,441 of these mine workers in the United States in 1920. The 4,161 best workers (assuming that the coal mine just cited is representative) would turn out 767,694,500 pounds of coal in a 12-day period, while in the same time the 4,161 poorest miners would produce only 64,079,400 pounds.

[1] *Report of the Industrial Fatigue Research Board*, No. 22.

Compared in another way, if 348 railway laborers could be found with abilities equal to those of the best miners—and it is very probable that they could be found—they could replace the 4,161 poor miners without decreasing production. Of these 4,161 relieved miners, 348 could take the vacated railway laborers' jobs, leaving 3,813 poor miners to be placed in other work. The coal mines are overmanned by much more than 3,813—only one-half of 1 per cent at the extremes has been considered.

When all workers in the United States are considered, this overmanning becomes a large item. There are 33,064,737 men engaged in gainful occupations. Probably one-half of 1 per cent of these (the speediest) produce twice as much as the slowest half of 1 per cent. It is also safe to assume that by a rearrangement of workers in industry the slowest half of 1 per cent could be replaced by half their number of more adept workers who have twice the abilities but are now engaged in other work. This would relieve 82,661 slow workers—one for each mail carrier or for each gas- and oil-well worker. Considering only the extreme half of 1 per cent, industry is overmanned to the extent of 82,661.

Reduction of Men or Hours.—For emphasis the preceding illustrations have shown how the number of employees could be reduced. Nothing, however, could be more foolhardy than to take as a goal the reduction of the working force, whether on a national scale or by individual plants.

I am informed by mechanical engineers that machinery is going to continue to make working hours shorter and shorter. From the viewpoint of industrial psychology I am certain that human engineering, too, will make similar inroads on the hours spent in the shop. The inroads could be made on the number of workers but modern industrial leaders have realized and seen the short-sightedness of such a policy.

THE DISTRIBUTION OF HUMAN ABILITIES

The illustrations already given may be misleading regarding the actual distribution of human differences. Common speech is also misleading. A mother speaks of one child as being musical and another not musical. The executive speaks of a good stenographer and a poor stenographer. These imply a distribution of human abilities such as is illustrated in Fig. 12. In this chart the figures given earlier for shoe operatives have

been used, although one might substitute "not musical" at the bar on the left and "musical" at the bar on the right, or "poor stenographer"—"good stenographer," "skilled—unskilled," "talented—not talented."

The gap separating individuals into well-marked classes is a falsification of the facts. Human abilities are not distributed in such a distinct way when the total range of human beings

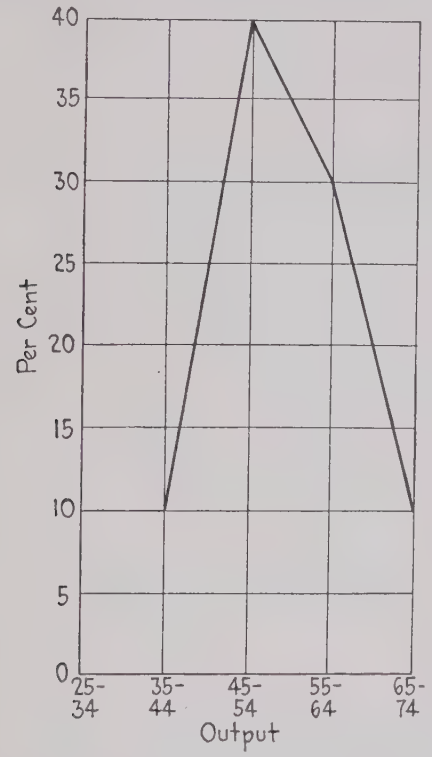


FIG. 13.—The distribution of productivity among ten workers. (*Data in Figs.* 13, 14, 15, *and* 16 *from Industrial Fatigue Research Board, Report No.* 4.)

is considered. When only two stenographers, or two children singing, or two shoe-workers are studied, a false appearance is given to individual differences. If more individuals were to be studied, the appearances would be altered.

This can be done using data that have been published relative to the output of women workers in a munitions plant.[1] Selecting

[1]*Report of the Industrial Fatigue Research Board,* No. 4. Their Table XX is used as the source for the material quoted.

the first ten instances that are recorded, the following frequency is found:

Output	Number of workers having this output
25 to 34	1
35 to 44	1
45 to 54	4
55 to 64	3
65 to 74	1

Obviously, the gap between the best and the poorest worker will be filled by other workers with medium abilities. Figure 13, in which the data given above are used, shows the distribution of the productivity of the ten workers. It begins to

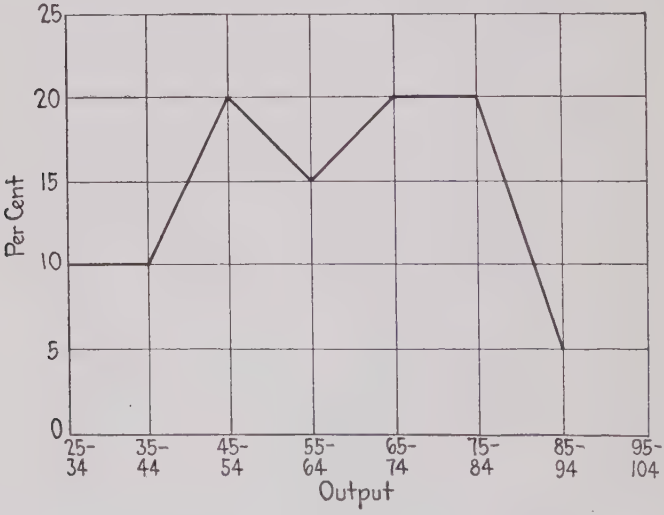


FIG. 14.—The number of workers charted in Fig. 13 has been doubled, with this change in the distribution curve.

appear that the best and the poorest workers are in the minority while the workers in the middle ground are greatest in number.

If the workers under observation are increased by ten, the records of the first twenty workers are as follows, and as in Fig. 14:

Output	Number of workers having this output
25 to 34	2
35 to 44	2
45 to 54	4
55 to 64	3
65 to 74	4
75 to 84	4
85 to 94	1
95 to 104	0

This increase in the number of persons studied changes the distribution conspicuously. First of all, workers with much greater productivity are included—although the selection was entirely at random. Secondly, as the number of individuals

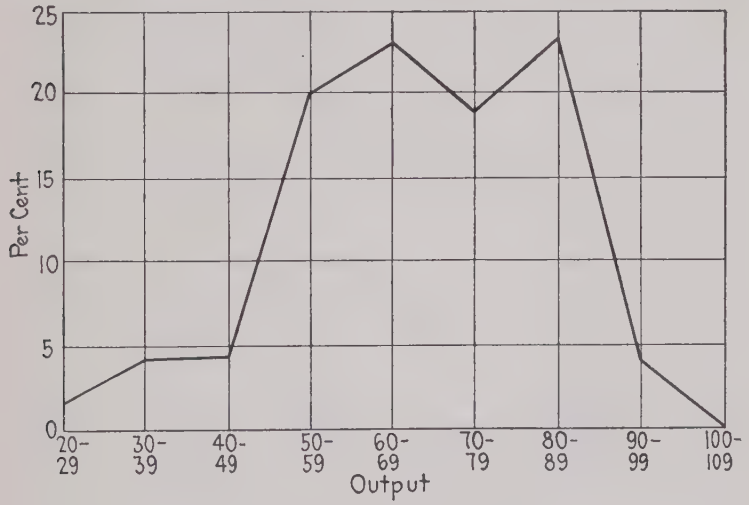


FIG. 15.—The distribution of productivity among 154 workers.

studied are increased, *the curve of distribution*, as charts such as these are called, becomes "fatter" in place of the tall, narrow distribution given in Fig. 13.

When the number of persons, whose individual variations are under observation, is increased to the following data, charted in Fig. 15, are found:

Output	Number of workers having this output
20 to 29	2
30 to 39	6
40 to 49	6
50 to 59	31
60 to 69	36
70 to 79	29
80 to 89	36
90 to 99	7
100 to 109	1

These additional data have increased the range, that is, the extreme limits, both high and low, of productivity. There are two slower workers and eight more productive workers than

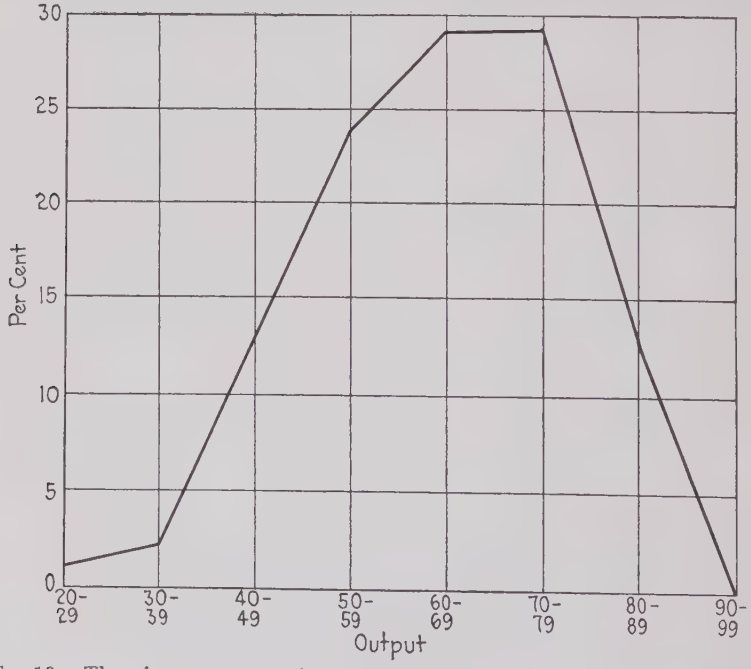


FIG. 16.—There is now an approximately normal distribution curve. The workers having accidents have been eliminated.

in Fig. 14. The general form of the distribution curve is changed only slightly, otherwise, and this change is in the direction of the height being increased.

A characteristic of the curves of Figs. 14 and 15, that leads the person familiar with scientific methods to doubt the reliability of the data, is the little notch occurring at about the midpoint of each of these curves. From what is known about the normal occurrence of individual differences, it is right at this mid-point it would be expected to find the curve highest, for reasons to be taken up shortly.

Accidents are inevitable around a machine shop, especially where large metal-working machinery is being operated by persons comparatively unfamiliar with mechanical devices. It would be thought that the occurrence of accidents would have some influence upon the output of the workers. In Fig. 13, three accidents are included in the data, and in Fig. 14 there are a total of six accidents included. The peculiar notch in the productivity curve appears first in the latter chart. The data last given included 49 accidents. When workers having accidents are eliminated, the following productivity occurs, which is also shown in Fig. 16:

Output	Number of workers having this output
20 to 29	1
30 to 39	2
40 to 49	13
50 to 59	23
60 to 69	27
70 to 79	27
80 to 89	13
90 to 99	0

Eliminating the cases in which accidents undoubtedly altered the productivity of the workers gives a distribution curve, highest at the approximate mid-point rather than having a drop in this section. It is important to notice that, from the least productive workers, there is a gradual increase in the number of workers with better output until the middle of the scale is reached, whereupon the number of workers who are increasingly superior gradually becomes less.

The majority of the workers are average. The extremes, the best, and the poorest, are not typical. The curve of the last

chart closely approximates what is known as a *normal distribution curve.* The name and significance of this sort of a curve can be best remembered by thinking of it as the way in which all normal differences appear. Greatly opposed characteristics occur normally in nature with least frequency. Giants and dwarfs are at the extreme ends of the distribution curve for height; there are more men 6 feet tall than men 6 feet, 1 inch tall.

All normal differences are found to distribute themselves in a bell-shaped curve. A few records, as in the example of the heel-trimmers, distorts the picture of individual differences. With 154 cases of women workers, a normal curve of distribution of productivity was not found because the data were not normal, due to the disturbing factor of accidents. If there were more

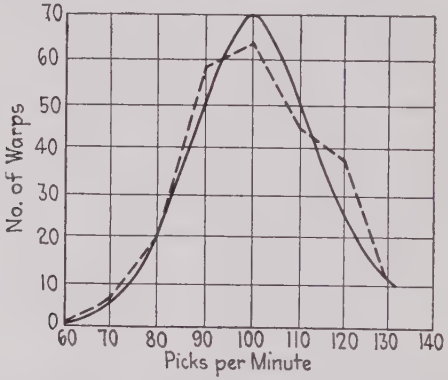


FIG. 17.—The distribution of output among silk weavers (dotted line) approximates a normal distribution (solid line). (*Data from Industrial Fatigue Research Board, Report No.* 17.)

cases in which all disturbing influences were removed, one would expect to find the differences in the workers conforming closely to the normal distribution curve. That silk weavers closely approximate this normal curve in their output is shown by the data in Fig. 17.

Undue emphasis cannot be given to the fact that all traits in normal individuals are found with the frequency characteristic of the normal distribution curve. The accompanying charts for the distribution of intelligence, tons of coal mined by individual miners, and mechanical ability, show conformity to this normal distribution.

This bell-shaped distribution is characteristic of *all human beings generally.* From among 100 applicants, the employment

psychologists may rest assured that the abilities will be found in a normal distribution. Roughly, half of them will have mediocre abilities; one-fourth of them will be superior, and the

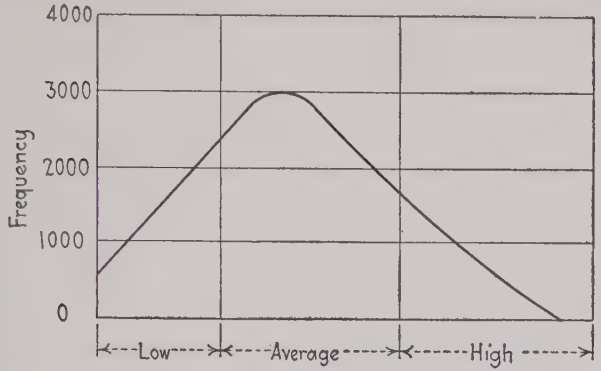


FIG. 18.—The distribution of general mental ability among soldiers. (*Memoir of the National Academy of Sciences, xv.*)

remaining fourth will be inferior. The ideal of employment selection is to choose only the best workers from the upper fourth. Whenever a large force of men has records kept of out-

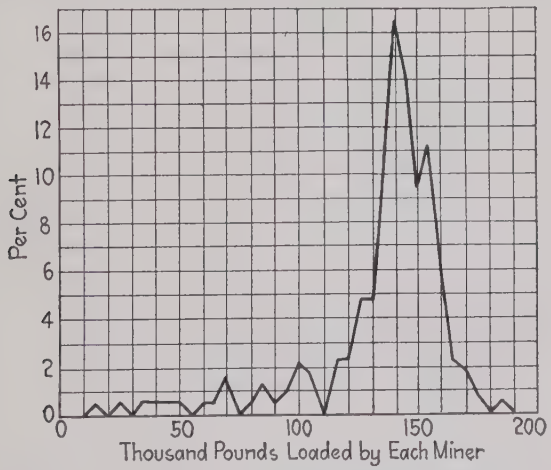


FIG. 19.—The output of miners at an Ohio mine conforms to the normal distribution curve. These data cover a 12-day period. (*Data from Hugh Archbald, E.M.*)

put, and these records approach the normal distribution curve, it is an indicator of poor selection. In a properly selected group of workers, the distribution curve should be compact, tall, and

narrow. There is a no more significant symbol representative of the goal of employment psychology than that shown in Fig. 21, in which the normal distribution curve is drawn in the solid line and a superior selection indicated by the broken lines.

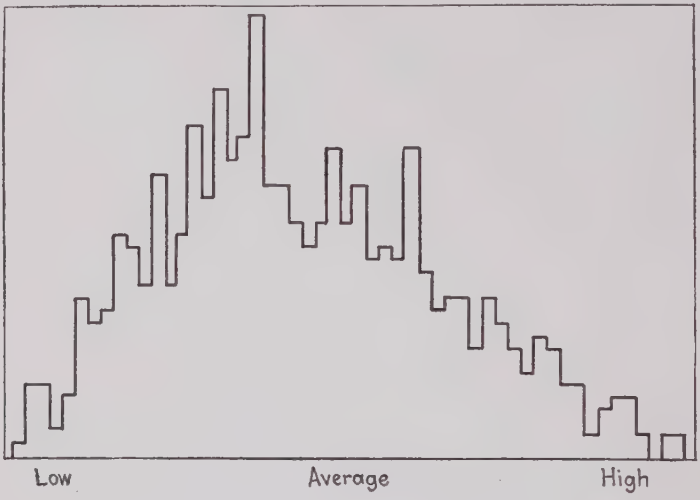


FIG. 20.—The distribution of mechanical ability among 718 school children (*Data from Dr. John L. Stenquist.*)

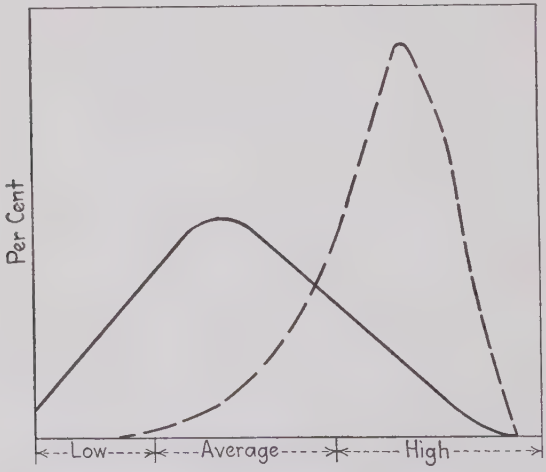


FIG. 21.—How general mental ability was distributed among enlisted men and officers. (*Memoir of the National Academy of Sciences, xv.*)

The data given in Fig. 21 were taken from the records of the psychological examinations used in the army. The solid lines

represent the intelligence records of 63,647 enlisted soldiers. Note that this closely approximates a normal distribution. The dotted lines represent the intelligence records of 5,563 commissioned officers. This does not approach a normal distribution because the officers are a highly selected group. That the officers could be better selected with respect to intelligence is evident from an examination of the left end of their distribution curve which gradually falls. The most desirable theoretical distribution for military officers would stop abruptly at the borderland of the superior class.

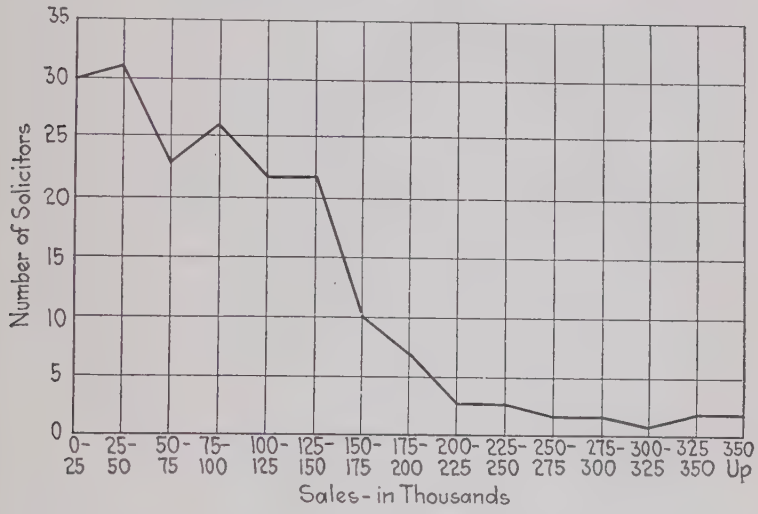


FIG. 22.—This is a *skewed curve*—but it is skewed toward the low end, exactly what is *not* wanted in selecting salesmen. This represents the distribution of sales by 186 full time insurance solicitors their first year. (*Data from Dr. Merrill J. Ream.*)

The failure of data, such as we have been discussing, to fall into the shape of a normal distribution curve, may be due to two factors: *first*, too few cases have been examined; and *second*, some selective or abnormal forces, such as commissioned officers, accidents, and disease may have been at work. The applicants for an industrial job have a normal distribution of capacity and ability. It is the task of the employment engineer to select only those who will give a *skewed* distribution, as that for the officers represents.

The close relationship between the normal distribution curve and the methods that must be used in the scientific treatment of

data used in employment selection makes it imperative that the few simple statements that have been made regarding the distribution of human differences be clearly understood.

THE NATURE OF INDIVIDUAL DIFFERENCES

All individual differences seem to be caused by differences in the amount of traits that each individual possesses. They do not appear to be caused by the expert possessing some peculiar "faculty" or mental twist not the common property of all men. A workman of ability differs from one with less ability in the same work only in the amounts of the factors determining that ability which each possesses.

One unaccustomed to thinking in psychological terms will readily agree to these statements, if he observes such mental functions as memory or imagination, which are possessed by all men, but in varying degrees. This observation must be extended to the concept of individual differences in all human abilities. There are many authors, but some have more ability in this line than others. There is nothing about "authoring" that gives evidence that writers have a monopoly of some peculiar mental power or ability that other human beings do not have. All could be piano tuners but some men, by having abilities for keener auditory discrimination, make more successful experts in this line of activity than ordinary men.

Professor Daniel Starch of Harvard says:

> Differences among human beings are quantitative rather than qualitative. That is, all human beings have the same reflexes, instincts, and capacities; all have the powers of perception, discrimination, attentiveness, retentiveness, reasoning, and so forth. All persons have the same general qualitative make-up. The variations from person to person are, therefore, primarily in the strength of the various abilities that each individual possesses, and in the manner in which amounts of the various traits combine in the same person.

The application of this knowledge to industry lies in the fact that every candidate interviewed has all the traits that are needed by, for example, a successful machine worker or bullet inspector. These individual traits may not be present in *amounts* large enough to permit the applicant to be a success in either of these lines, or they may be in quantitative combination with other traits that are detrimental to the work in question. Machinists are no different from bullet inspectors in the traits

they have; their differences arise from the different amounts or combinations of these separate traits. The one type of worker does not have some traits that are totally absent from the other.

The fundamental problem in employment, accordingly, becomes the *measurement* of the amounts of these traits that are present in each applicant or worker. Nothing would be more futile than to go in quest of traits that one has and another has not. Amounts must be measured, and the methods are thereby made more rigorous than if one were merely looking for the presence of a trait.

TYPE THEORIES OF HUMAN DIFFERENCES

Early psychological studies were, to a considerable extent, centered around the endeavor to demonstrate and describe different *types* of human beings. It has been indicated that popular speech does this in the use of such descriptive terms as bright—dull, good—bad, artistic—not artistic, men of action—men of thought, careful workers—careless workers, and so on. It has been found that these verbal distinctions may hold for the extremes, but are not genuinely indicative of the differences found in a large group of human beings. Without explicitly denying this fact of an even gradation in human traits, early psychological students gathered data which seemed to indicate the existence of well-marked mental types.

Perhaps the most instructive group of types was fabricated in connection with mental imagery. Galton was the first to study this with the aid of questions such as these:

1. Think of a bunch of white rose-buds, lying among fern leaves in a florist's box.

(*a*) Are the colors—the creamy white, the green, the shiny white—quite distinct and natural?

(*b*) Are the flowers and leaves and box well-defined and clear-cut?

2. Think of the national anthem.

(*a*) Can you see the words printed? Can you hear yourself singing them? Can you hear a company singing them? Can you hear the organ playing the air?

3. Arrange the following twenty experiences in groups, according to the clearness, vividness, and distinctness with which you can remember or imagine them.

(*a*) A gloomy, cloudy sky; a sheet of yellow paper; a black circle on a white ground.

(*b*) The feel of velvet; of dough; of a crisp, dead leaf.

(*c*) The smell of tar; of a fur coat; of an oil lamp just blown out.

(*d*) The taste of chocolate; of olives; of pastry.

(*e*) The warmth of a hot-water bag at your feet; the cold of a piercing wind that cuts through your clothing.

(*f*) Singing in the ear; the buzz of an induction-coil; the preliminary *a* of the violin.

Investigators, with questions such as the above, were impressed, half a century ago, by the fact that one person could imagine the color of the rose leaves while he could not imagine the buzz of an induction coil. Soon such a person came to be called eye-minded. It was not long before elaborate schemes of individual types, by

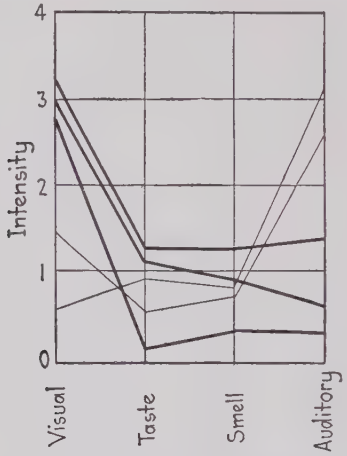


FIG. 23.—How imagery would show up in individuals if the type theory held.

which numerous well-defined differences in imagery were supposed to exist, were fabricated. The special type of imagery that the scientist was supposed to have was formulated; another special type characteristic of the clergy was described. Teachers were instructed in the normal schools to teach some pupils in one way because they were supposed to be ear-minded and other pupils were to be taught in other ways because they were assumed to be eye-minded.

The "pure types" which were postulated and expected to be found would have appeared something like Fig. 23 when charted. In this chart, only visual, auditory, taste, and smell imagery at the points indicated have been represented. The vertical distance from the base line represents the degree of vividness,

fidelity, and frequency of the imagery of the varieties indicated along the base. The different lines represent different individuals. It will appear upon examination of this chart that the hypothetical individuals represented fall into two distinct groups. There are two individuals whose predominant imagery seems to be auditory while their other imageries are weak; there are three others charted preeminently visual in their imagery. It must be borne in mind that these are *hypothetical individuals.* It was necessary to make individuals to suit the doctrine since, in the actual persons studied, it was practically impossible to find any

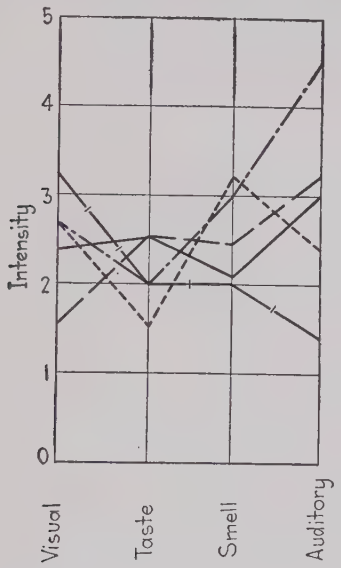


FIG. 24.—How imagery is actually found. (*Data from Dr. G. H. Betts.*)

that fitted the classification of "pure types." But this lack did not prevent names being given to these hypothetical cases, and those subjects with dominating visual imagery were dubbed "visuels," and the others, supposedly deficient in visual imagery but strong in auditory imagery, were dubbed "audiles." In our chart, there are three "visuels" and two "audiles."

The present scientific status of imagery types may be illustrated by the following quotation from the German psychologist Meuman:

How rare the pure types (of imagery) are amongst children is witnessed by the fact that, in our extensive investigations of children

at Zurich, we have never found a perfectly pure type in the case of children.

What are the facts? Meuman has already been quoted. Dr. E. L. Thorndike of Columbia University writes:

> The pillars of the doctrine (of pure types) were the separation of men into types according to the predominance of images from one sense, and the inverse relations between sense-spheres in respect to the extent and perfection of imagery. Facts showed opinion to have been grossly in error as a result of its assumption that there must be distinct types of some sort. The contrary is true. Instead of a few "pure" types or many mixed types, there is one type-mediocrity. Instead of antagonism between the development of imagery from one sense and that from other senses there is a close correlation.

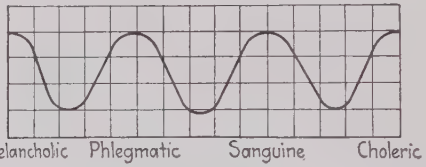


FIG. 25.—If we were to believe the dictionary the temperaments would be distributed after this fashion.

In Fig. 24 there are given the records of some real persons in imagery tests similar to the one used by Galton. These data were gathered by Dr. G. H. Betts[1] and show that "pure types" are a myth. Examination of this chart will show that the distinct types as pictured in Fig. 23 are conspicuous by their absence. In place of distinctly different types, there are no two individuals even approximately alike; in common, they have all varieties and degrees of imagery. The point is not merely to show, that the types as such do not exist, but that there are wide individual variations in the strength of imagery. This can be realized by comparing the curve for the individuals at the top with other curves at the bottom of the chart. "Audiles" and "visuels" do not exist, but there are important differences in the strength, vividness, fidelity, and utility of mental images. So, while the discussion of the theory of types has been gone into at length, this discussion has not been wasted. It is as important to realize that there are marked variations in the powers of imagery as to know that there are not distinct types.

[1] *Teachers' College Contributions to Education*, No. 26.

Other divisions of men into types, which are given in books, probably do not exist in real life. Such, for example, is the division of mankind into temperaments. It has been classically assumed that the choleric, sanguine, phlegmatic, and melancholic are found among 100 men as shown in Fig. 25, when, as a

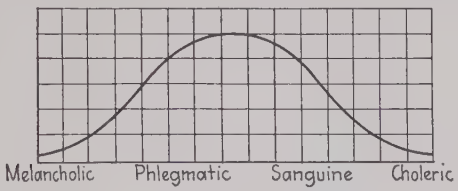


FIG. 26.—It is more in harmony with the facts of individual differences, however, to find the temperaments distributed according to the normal distribution curve.

matter of fact, it is a closer approximation to the knowledge of the distribution and nature of individual differences that they be found as in Fig. 26. Here again, it is as important for the employment psychologist to realize that there are variations in temperaments as it is for him to realize that they probably do not fall into distinct and readily discernible classes or types. The

The human element.

1. Physical requirements:
   - (a) Size of man—tall, short, heavy.
   - (b) Muscles—strong in arms, back, in legs, etc.
   - (c) Eyesight and hearing.
   - (d) Normal, cripple, etc.
   - (e) Age and sex.
2. Nationality preferred.
3. Mental characteristics.
   - (a) Education, trade, or experience necessary.
   - (b) Type of mind:

1. Mental type.	2. Manual type.
3. Settled type.	4. Roving type.
5. Indoor man.	6. Outdoor man.
7. Directive.	8. Dependent personality.
9. Large dimension worker.	10. Small dimension worker.
11. Adaptable personality.	12. Self-centered personality.
13. Deliberate.	14. Impulsive.
15. Dynamic.	16. Static.

FIG. 27.—This job analysis, used by a large steel manufacturer, proceeds on the assumption that there are distinct types. (See also Chapter XIII.)

result, however, is to make the selection of workers a more difficult matter. Instead of merely looking for the presence or for the absence of traits that would classify men by non-existent types, it becomes necessary to *measure* the amounts of each of the traits possessed by the applicant. Chemists know that it is easier to detect the presence of oxygen in a substance than it is to

measure the exact amount of oxygen present, and experts have found it easier to determine that one shop is more efficient than another than to measure accurately just how much more efficient it really is. Employment managers will discover it more difficult to measure traits than to search for them in every applicant.

The illustrations have been limited mainly to imagery and temperaments. Any other attempted classifications of "human types" could probably have been used with equal justification.

The time-worn comparison of the exponent of better methods in employment turns out to be ill-founded. Reference has been made to the old notion of round pegs in square holes. There are no round and no square humans. All are either round or square, it makes no difference which for purposes of ridding ourselves of this conception that is almost synonymous with "scientific employment." The difference is not in roundness or squareness, but in the amount of the abilities that the applicant possesses. What some would call a round peg trying to be fitted into a square hole is, in fact, a small, square peg rattling around in a large square hole, or a large square peg squeezed and cramped in a small square hole.

The psychologist agrees implicitly with the theological conception that we are all created in the divine image—only some are big images while others are little images. Some are images reflected from a distorted mirror but the resemblance and underlying homogeneity is present.

What causes some reflections to be small and others large? What makes some images appear as in a twisted mirror?

CHAPTER IV

THE ORIGIN OF INDIVIDUAL DIFFERENCES

What is the cause of the individual differences which, at times, are almost appalling in their magnitude? Several lines of evidence should be passed in hasty review before an attempt is made to answer this question which is of great importance in management and selection.

The first problem is to see what evidence there is for the assertion that mental traits and human abilities in general are the result of inheritance or of environmental influences. It is important to know whether individual differences are the result of the environment in which a person lives or whether they are the result of something that is inborn and unchangeable. If they can be changed, training may be more important than proper selection

GENERAL ABILITIES

In the psychological examining in the army, it was found that the median intelligence scores, expressed roughly in mental ages, for those recruits who could read and write were as follows:

Native born whites	13.5 years
Northern negroes	12.5 years
Southern negroes	10.0 years

The native white of the United States has a different level of intelligence than the negro. If the blood of negro and the white intermingles, there is a fading out, as it were, of the color, which can be attributed to nothing but inheritance. What happens in the case of intellectual abilities, as expressed in terms of mental ages, under the same circumstances?

Data to answer this question were reported from Camp Lee on June 6, 1918. The information was based upon the examination of two battalions of negro troops that had been divided into two groups on the basis of skin color. The following tabulation gives the median mental development (in years) of the dark and of the light negroes:

	Literates	Illiterates
Light	13	10.5
Dark	12	10

These data indicate that the intelligence of the light negro is raised by the presence of white blood just as his skin color is also altered. There can be no environmental influences operative since the light and the dark negroes are living in the same surroundings.

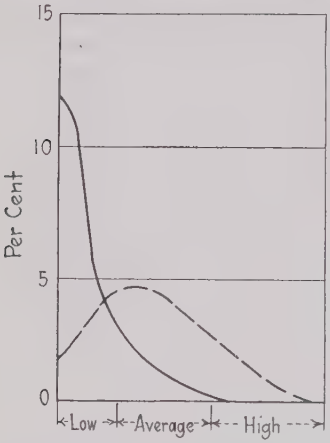


FIG. 28.—Negro men from 21 to 30 years old are below white men of the same age range in general mental ability. The curves stop short on the low end because the tests did not measure low enough to tell individuals apart when they were of very low abilities.

Examination of the earlier table reveals that southern negroes are decidedly lower in mental age than northern negroes. Can this difference be the result of the action of a more favorable environment? Some popular writers have suggested this as being the case, maintaining that the intelligence of the negro is improved by being given a favorable environment. Is this true? There are several possibilities to take into account before a decision can be rendered.

First of all, the negro in the north is a new phenomenon. It is only within relatively recent years that he has migrated to the north to any appreciable extent. This is suggestive of two possibilities. One is that the negro has scarcely been in the north long enough for any environmental modifications to take place; the second is that the more intelligent negro from the south is the one who migrates. There is a fairly close relation between prosperity and intelligence which suggests that the more intelligent of the southern negroes are the only ones who can save enough to make the northern migration.

Then there is the possibility that the cross-breeding with the whites is more common among northern negroes, resulting in the increased intellectual level. This is somewhat invalidated,

however, by the fact that most of the negroes tested in the army drafts had been born in the south and had migrated to the north.

The difference cannot be attributed to educational opportunities for:[1] "The southern negro group, lowest in each comparison, is nevertheless farther removed from the others in intelligence rating than it is in schooling."

The marked difference between the mental abilities of the northern and the southern negro is well established. There are no specific facts, however, which will make it possible to explain this difference. The various possibilities have been only briefly mentioned, for it is dangerous to enter into elaborate speculations without any foundation other than opinion, and time is much better invested gathering valid data than indulging in fanciful explanations.

The mental abilities of the Indian have likewise been found to be modified favorably by the addition of white blood.

DOES EDUCATION ALTER CAPACITIES?

By far the strongest single environmental factor is education. Still, records show that even this agency is relatively impotent in altering the original nature of individuals. There are two distinct lines of evidence for this statement. One concerns the abilities of individuals after having passed through the educational systems, and the other is concerned with the changes that take place in children as they are progressing through the schools.

Dr. Paul Popenoe[2] has compared the intelligence records of different groups of individuals with the same amount of schooling. His data were obtained from the records of the intelligence testing of the army drafts. He found the following scores for the average of each of the groups indicated, a high score meaning relatively higher intelligence than a low score:

	Whites, native born	Whites, foreign born	Northern negro	Southern negro
Average scores				
With fourth-grade schooling.....	23.4	26.6	19.8	8.4
With eighth-grade schooling.....	64.4	59.4	50.0	28.9

[1] "Memoirs National Academy of Sciences," vol. XV, 766 pp.

[2] Journal of Heredity, p. 190, 1922.

The same amount of education has not equalized the intellectual abilities of the different groups. This fact is apparent especially in a comparison of recruits who had completed the eighth grade only with officers who had had the same education. The average score of the former was 64.4 while the average for the latter was 108.1.

Commenting upon these data Dr. Popenoe says:

> A similar relation holds at the high school and college levels, although here the foreign born show at greater disadvantage compared with the native born. Among college graduates, the native born men in the ranks make just about as good a showing as do the officers. It is plausibly explained that the intelligence necessary to graduate from college is requisite in an officer, but that college graduates—a highly selected group, amounting to no more than one in a hundred of the young men of the country—who find themselves, as a result of the draft, in the ranks, are of the same order of intelligence as those of their number who became officers.
>
> Another comparison that is decidedly illuminating is that between officers who get no farther than the eighth grade and native born white recruits who have a high school or college education. "Every recruit in the recruit group (12,943) has had more schooling than any officer in the officer group (660); the least educated recruit in the group has had a longer education than the best educated officer included"; and the men are of similar racial stock. The median scores of these groups are, officers 107.3, recruits 97.4.

From this it is apparent that the differences in general mental ability, as measured by the army tests, are not a result of educational advantages. Rather do they appear to be inborn in the individuals, each one being endowed with a capacity beyond which neither education nor a favorable environment can lift him, just as the gnarled apple tree can never be transformed into a stalwart maple by favorable soils.

Other data have been gathered by Dr. L. W. Pressy relative to the possibility of educational advantages modifying individuals so that one comes to surpass another in abilities. In her extensive measurements of the general mental alertness of public school children in Indiana, Dr. Pressy discovered very significant differences in these abilities between country and city children. Thinking that the differences might possibly be due to city children having better educational advantages, she compared the scores of the children who were just starting school with those

who had been in school for several years. If the differences had been due to better schooling, country children, just starting school, would be expected to be to equal in abilities to city children just starting school, while, in the higher grades, the city children would show a higher rating due to their alleged superior educational opportunities. After a study of fourteen country schools, Dr. Pressy found that only 22 per cent of the country children just beginning school did as well on the tests as 50 per cent of the city beginners.[1] In the case of the older children it was found that only 20 per cent of the rural children did as well as more than half of the city children. Since country children are as much below city children upon starting school as they are after several years of schooling, the difference cannot be accounted for by maintaining that city schools are better than country schools. Perhaps there is a difference in the schools but, if there is, it has no effect upon the abilities of these children in the tests.

In his studies of the intelligence of city children, Dr. Pressy also found rather marked differences between the children of the professional, artisan, executive, and laboring classes. The children of the professional classes were greatly above average in intelligence; the children from the executive classes were slightly above the average; the children from the families of artisans were about average, while the children from the laboring classes were very distinctly below average. Again, in search of positive indications that education or environment might be partly the cause of these differences, Dr. Pressy compared the children six, seven, and eight years old with those from ten to fourteen years of age. The following table shows what was found:

	Per cent of children above median for age			
	Professional	Artisan	Executive	Laborer
Six to eight years.....	79	54	60	38
Ten to fourteen years.....	85	41	68	39

These data indicate that the differences between the classes considered are not eradicated or unduly magnified by opportunities. Four years of additional schooling in the same schools

[1] *Journal of Applied Psychology*, p. 91, 1920.

does not raise the abilities of the laborers' children to the level of the children of artisans or executives. The differences persist as do the differences between city and country children. If the early superiority of the children from the professional classes were due to better opportunities before entering school, one would be led to expect a considerable decrease in this superiority after the children of all the classes had attended the same schools.

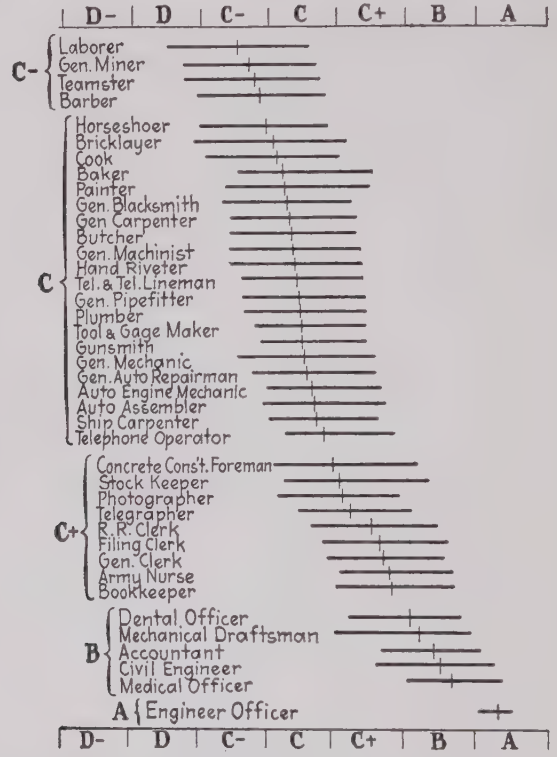


FIG. 29.—Like father, like son? The bars represent the middle 50 per cent of different occupations, the position of the bar from right to left shows the standing in general mental ability, as indicated along the bottom. (*Data from Memoir of the National Academy of Sciences, xv.*)

What Dr. Pressy found to be true about children also holds for adults from the same economic levels. The following tabulation shows the ratings of adults from certain economic levels in the intelligence testing in the army. In the scores reported, a high score indicates high ability. All the individuals included were able to read and write.

Occupation	Score
Laborer	47
Teamster	59
Miner	49
Farmer	48
Bricklayer	58
Plumber	66
Painter	59
Telegrapher	85
Stockkeeper	78
General clerk	96
Bookkeeper	101
Filing clerk	97
Engineer[1]	162
Dentist	122
Physician	122
Chaplain	160

[1] This and the following three give the median scores for first lieutenants.

"Like parent, like child" seems to be true for general mental abilities. Despite our citation of the data from the psychological

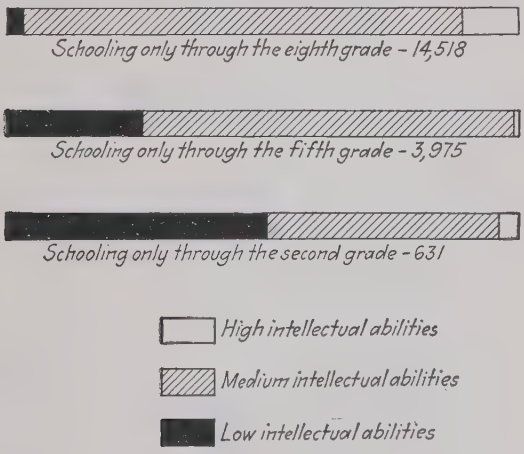

Schooling only through the eighth grade - 14,518
Schooling only through the fifth grade - 3,975
Schooling only through the second grade - 631
High intellectual abilities
Medium intellectual abilities
Low intellectual abilities

FIG. 30.—Educational opportunity *seems* to improve general mental ability, as these bars show.

examining in the army to show that education did not account for differences in intelligence, it is sometimes maintained that the

more education one has the higher intelligence score he has. There is some factual justification for this assertion, but it is a result of a misinterpretation of the facts. Adults who left school after the fifth grade do have lower intelligence scores, on the average, than those who left at the close of the eighth, who, in turn, are below the intellectual level of those who completed high school. On the surface, it might appear from this that education does increase mental alertness.

Dr. Gustave A. Feingold has recently published data that clearly indicate the fallacies in this sort of reasoning.[1] He has made a study of some 4,000 high school children representing fifteen different nationalities at Hartford, Conn. He made a special study of the intellectual levels of children who quit school. He says:

> Some drop out for economic reasons, others because they are not fond of book learning, and still others because they are eager to become financially independent of their parents' purse. But when we come to investigate what kind of individuals drop out in the largest proportion, we find that, as revealed by tests, it is those who lack the sheer mental ability to do regular high school work. If we take a high school entering class of 1,000 pupils and give them an intelligence test, we find that approximately 100, or 10 per cent will be mentally superior . . . about 650, or 65 per cent, will have average intelligence, . . . some 250, or 25 per cent, will have less than average intelligence.
>
> Now what happens to each of these three mental groups in the successive high school semesters? Confining our investigation to the Hartford High School, wherein the system of semi-annual promotion prevails, we observe that of the superior pupils 10.6 per cent will have dropped out by the beginning of the sophomore year. An additional 8 per cent will have dropped out by the beginning of the junior year, and another 1.4 per cent will have dropped out by the beginning of the senior year. Thus by the end of 3 years some 20 per cent will have left school, while fully 80 per cent will graduate . . . On the other hand, among the lowest mental group, fully 55.4 per cent will have dropped out by the end of the first year, another 22.5 per cent will have dropped out by the end of the second year, and almost a total of 81 per cent will have dropped out by the end of the third year. In other words, only 19 per cent of them will be left in the high school at the end of 3 years or long enough to enter the senior class.

In the accompanying chart (Fig. 31) the percentage of children from each mental group remaining in high school at the end of

[1] *School and Society*, Oct. 13, 1923.

each successive term is shown. It should be apparent now why high school graduates generally have better scores in tests of mental alertness than those who have not had the benefits of a similar education. It requires average or above average mental abilities to graduate from high school. The 4 years of education have not increased the mental abilities of the students so that they can score higher than others. The graduating students scored better as freshman, 4 years before graduation, than those who left school and entered industry.

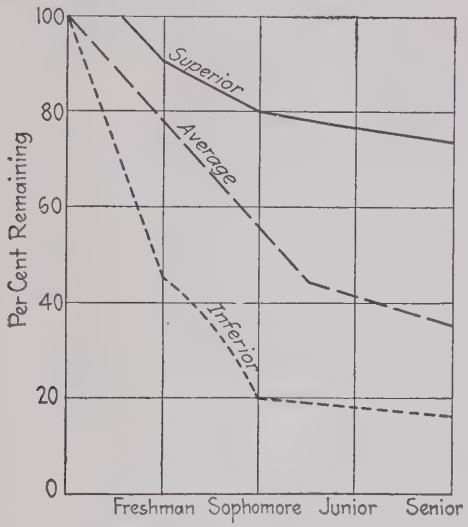


FIG. 31.—This shows why general mental ability seems to improve with education. (Explanation in text.)

Parallel differences between the intelligence scores of Yale College freshmen and the recruits in the army, as shown in Fig. 32, are not due to differences in educational opportunities. It is the differences in mental abilities that have made it possible for the one group to complete a high school course. This difference in the main (there may be scattering exceptions) is additional evidence of differences in abilities rather than the cause of these differences. (Compare the exceptions with the army officers and high school graduates cited on page 60.)

Other direct evidence of the failure of education to modify individual abilities and differences is found in the successive tests of the same children, year after year in the public schools. If their educational opportunities are modifying their abilities in

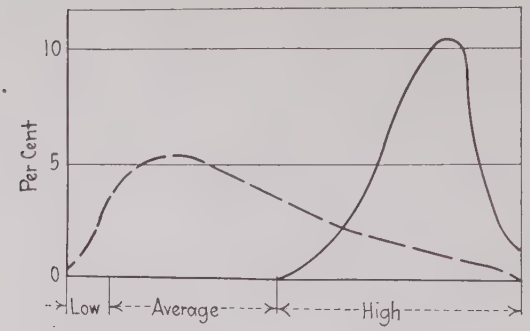


FIG. 32.—Yale freshmen (solid line) are much above 31,503 men from 21 to 30 years old in general mental ability (*Data from Dr. John E. Anderson.*)

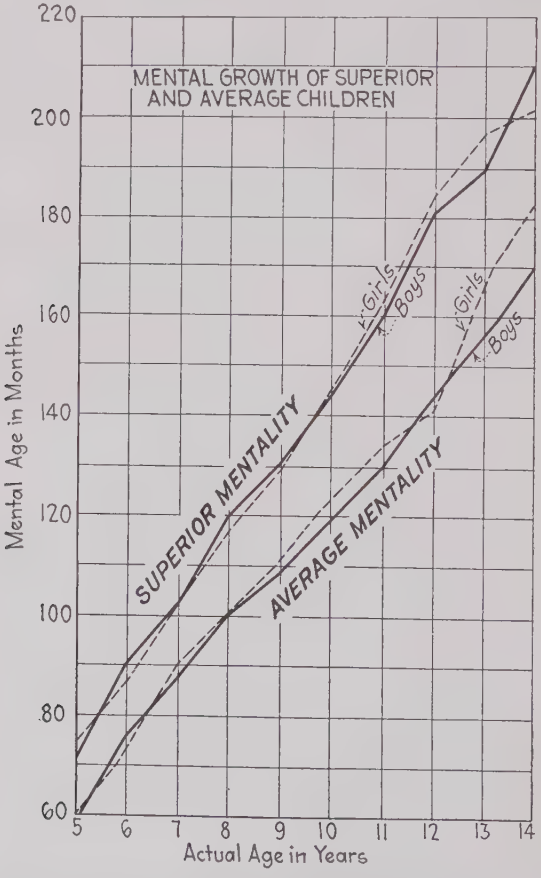


FIG. 33.—In spite of schooling in the same schools for several years differences in mental ability persist. (*Data from Dr. B. T. Baldwin and Dr. L. I. Stecher.*)

any way, an observer would expect a rapid growth. The data, however, give no indications of increased growth due to the influences of schooling.

The data for Fig. 33 were obtained from the successive measurement of the mental abilities of children over a period of several years. These children were attending the same school and were from about the same social level in a small city, their environ-

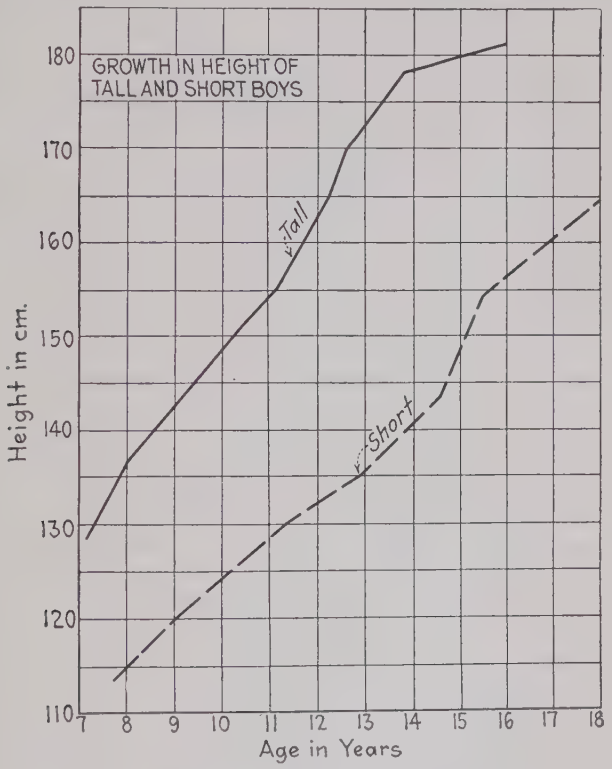


FIG. 34.—Tall boys make tall men; food does not account for most of the differences in height. (*Data from Dr. B. T. Baldwin.*)

mental forces being largely identical. It would be expected that this sameness of environment would make them more alike, but the chart shows that the children who were average in intelligence at five remained average, while the children who were superior at five remained superior. The slight fanning out of the curves at the higher ages may be an indication that the differences are increasing rather than remaining constant.

In physical development, the same persistence of differences is to be observed, as shown in Fig. 34. The boys who are short at eight are also short at sixteen, while the tall boys of eight are the tall boys of sixteen. Environment does not alter these differences so much but that it is possible to predict at eight years which will be the larger of two boys. Adult individual differences in mental capacities can also be predicted at a surprisingly early age, so tenaciously do most of them resist environmental influences.

Physical development may be modified by food, however, and individual differences changed at an early age. Rickets, which alters the osseous system and the individual's stature, is caused by diet deficient in certain food values, and it may be properly classed as an individual difference that is due to some cause external to the individual.

Even in instances such as these, however, there are indications of something within the individual, something that is apparently inborn, that controls the destiny of the individual's characteristics. Drs. T. B. Osborne and L. B. Mendel at Yale University[1] have found that, when rats are fed food from which some substances have been removed, growth is almost instantaneously stopped. In this way a group of dwarf individuals are produced. But as soon as the stunted rats are again given a diet from which the tryptophan has not been removed, even after the lapse of several months, they begin to grow and soon reach a normal stature. There are obvious limitations to food being used to modify individual stature or physical build. It is rather difficult to conceive of a bantam being changed into a Plymouth Rock by feeding it large amounts of food, or of changing the voice of a woman into that of a man by using corn syrup, or of changing an Abraham Lincoln into a Chief Justice Taft by employing the most highly concentrated foods on the grocer's shelves.

Likewise, and this is more than analogy, it is not expected that education or opportunity will make average children into prodigies with superior abilities, or the non-musical person into an opera artist, or the bungling mechanic into a skilled worker, or the slow typist into a rapid worker. It appears that a limit has been set to the general abilities of each individual, beyond which it is impossible for the best of opportunities and training to raise him. There is no denying the fact that education and

[1] *Journal of Biological Chemistry*, p. 95, 1914.

training do have a veneering effect. But it is indisputable, however, that the fundamental capacities of an individual are modified but little by training. Training simply gives him the tools with which to work.

SPECIAL ABILITIES

The members of a family, as a rule, have certain characteristics in common which identify them to their friends as one of the Joneses, or the Smiths, or the Elmendorfs. If individual differences are caused by heredity, one would expect the differences in a group of related children, such as brothers and sisters in which the heredity is apparently the same, to be much less than in a group of unrelated or distantly related children. If living in the same environment rather than having a common heredity is the cause of the resemblance among children with the same parents, one would be led to expect the resemblances to increase with age. If environment has little to do with decreasing the individual differences when persons are living under the same conditions, the resemblances of young children would be the same as for older children. With this as a preliminary, some actual measurements, that have been made to determine precisely these points, will be reported.

In *physical traits* of brothers and sisters (siblings), Dr. Karl Pearson found the following degrees of resemblance, in which 1.00 would mean perfect resemblance and 0.00 no resemblance:

Hair color	0.55
Cephalic index	0.49
Height	0.50
Eye color	0.52

The resemblance between siblings averages about 0.50 in these physical traits. These traits are generally admitted to be inborn and not subject to environmental influences.

Are the resemblances of siblings in mental traits equally as noticeable?

Professor Daniel Starch found a resemblance, approximately equal to the physical resemblance obtained by Pearson, in data from eighteen pairs of brothers and sisters at the University of Wisconsin. Tests both of abilities in which they had been trained for a considerable time (school subjects), as well as tests of mental abilities in general, were used. In order to obtain an accurate measure, each of the tests were taken twice by each one

of the subjects being examined. It should also be emphasized that the tests of school work were of the objective type, such as are discussed in Chap. XIII, so that the teachers' opinions do not modify the data. His findings follow:

RESEMBLANCE BETWEEN ABILITIES OF BROTHERS AND SISTERS

Reading—speed	0.51
Reading—comprehension	0.64
Writing—speed	0.72
Writing—quality	0.46
Size of reading vocabulary	0.07
Spelling	0.05
Arithmetical reasoning	0.38
Addition—attempted	0.71
Addition—right	0.44
Subtraction—attempted	0.43
Subtraction—right	0.29
Multiplication—attempted	0.37
Multiplication—right	0.25
Division—attempted	0.46
Division—right	0.56
Average of educational	0.42
Memory	0.31
A-test	0.50
Form test	0.07
Tapping	0.65
Average	0.38

Commenting on these data Professor Starch says:

From the table several results appear. 1. The resemblance of siblings is apparently no greater in those mental traits which are directly affected by school work than in those which are not so affected. The average correlation in the former group of tests is 0.42 and in the latter 0.38. This seems to indicate that the mental similarities of children of the same parents are due primarily to heredity rather than to similarity of environment since the resemblance is no greater in those traits which are more directly affected by the environment.

2. The resemblance of siblings is approximately as great in mental traits as in physical traits. Pearson found the correlation between brother and brother in height to be 0.50, and in cephalic index (ratio of length to width of head) 0.49. These correlations for physical traits are a little larger than the ones found here for mental traits taken separately. The correlation, however, calculated on the basis of a combined rank for each person in all mental tests together was found to be 0.73. This greater correlation for all tests combined as com-

pared with the correlation for single traits is due partly to the variation of the correlations among the single traits and partly to the imperfections in the separate tests, which are counterbalanced to some extent in a combined ranking.

Measurements of *twins* in six mental and eight physical characteristics are reported by Thorndike.[1] He measured fifty pairs of twins who could be located in the New York public schools. The twins were from nine to fifteen years old. He found much more resemblance between twins than between unrelated children or even brothers and sisters. For his fifty pairs of twins, he found the following "coefficients of resemblance:"

Resemblance in six mental traits	0.78
Resemblance in eight physical traits	0.76

The higher the coefficient of resemblance, the greater the likeness between the children being compared. The mental resemblances of twins are almost twice as great as those of ordinary brothers and sisters.

This greater resemblance may be due to twins having practically the same environment rather than to their having an inheritance that is identical. Professor Thorndike compared the resemblance of the twins from nine to eleven years old with the corresponding resemblance of twins from twelve to fifteen years old to see if training did have much to do with the resemblance. If environment had produced the resemblance, he expected to find the coefficients of resemblance increasing with age. What was found is shown in the following table:

THE MENTAL RESEMBLANCES OF YOUNG AND OF OLD TWINS

Mental trait	Resemblance	
	Nine to eleven years	Twelve to fifteen years
1. A test	0.66	0.73
2. Word test	0.81	0.62
3. Mispelled word test	0.76	0.74
4. Addition	0.90	0.54
5. Multiplication	0.91	0.69
6. Opposites	0.96	0.88

[1] THORNDIKE, E. L.: "Archives of Philosophy, Psychology, and Scientific Methods," No. 1, 1905.

These data show that the resemblance of young twins is greater than that of old twins. A long period in the same environment tends to make them different rather than more alike. The coefficients of resemblance of those tests which would seem to be most influenced by education follow; 4, 5, and 6 being the tests most likely to reflect education:

Mental traits	Resemblance	
	Nine to eleven years	Twelve to fifteen years
1, 2, and 3 above.....	0.71	0.69
4, 5, and 6 above.....	0.90	0.75

The data on twins may be summarized by stating that their mental resemblances are practically twice as great as the corresponding resemblances in siblings, and that with increased age there is a slight decline in the degree of resemblance in the traits that would be least modified by education and environment, while there is a considerable decline in resemblance in the traits that would be most modified by these external agencies. The identity of environment has not made the twins closely identical in mental characteristics. Rather does it appear to increase the differences in the traits most intimately connected with training and education.

A comparison of twins, who have been raised in different environments since they were 8 months old, has been recently reported by Popenoe.[1] These cases are of great interest although there are no exact psychological measurements of their mental resemblances. The twins, who were girls, were separated by adoption upon the death of their mother. From the time of their adoption until they were eighteen, they had neither seen nor heard about each other. They had spent 2 months together in 1911, 2 months again in 1913, and 6 months in 1914.

Their physical resemblances are remarkable. They look practically identical, always weigh about the same, the color of their hair is the same, and their voices undistinguishable. In regard to their mental traits, one of them writes:

> We are both high strung and do not seem to conserve our energies as we should . . . We both favor history, social study, thought

[1] *Journal of Heredity*, p. 142, 1922.

functions, and politics. Neither of us cares for mathematics, nor are we what might be called good students. We are too "smattery," although we learn rapidly and with little effort.

MUSICAL CAPACITIES

That musicians are born, not made, is a matter of common observation, especially since the popularization of the saxophone. Tests have been devised to measure what degree of the fundamental abilities that enter into the symptom-complex known as musical ability an individual has. These tests are not altered by training although one's musical performance may be.

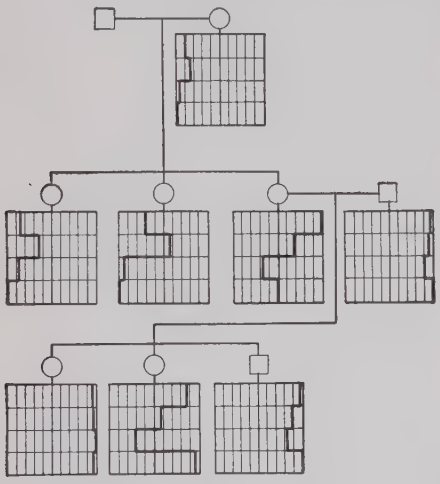


FIG. 35.—Specific musical capacities appear to be inborn. (Explanation in text. *Data from Dr. H. M. Stanton.*)

The tests have been given to several generations of the same family, with findings such as are shown in Fig. 35. In this *musical capacity pedigree chart*, men are represented by the small squares, women by the circles. Where the center line of these figures is drawn between them, it represents a mating. In the present family, we have a record at the top of one mating. At the time of the experiments the man was dead but tests of musical capacities were given to the woman. Her standing in these tests is shown by the larger square. The top row in this square is used to show the rating in pitch discrimination; ability to distinguish differences in intensity of tone in the second row; ability to distinguish different time intervals in the third row, and musical memory in the bottom row. Each row is divided

into ten sections and a mark made in the proper section to indicate the person's rank in each test. The nearer this mark is to the right end of each section, the greater the capacity.

The woman, with which this explanation was started, apparently does not have marked musical capacities. Of her three children, two seem to be somewhat below the average in all these traits, while the third is unusually high in discriminating pitch. This one child, with musical abilities higher than the other two, married a man with marked musical abiiities, as the chart shows. Three offspring of this union were studied and found to be unusually musical in capacity, the one girl to the left making almost perfect scores in all four tests of capacity.

Other families studied seem to justify the following conclusions:

> Those parents who are musical and whose ancestry is musical on one or both sides tend to have musical children; those parents who are not musical and have a non-musical ancestry on both sides tend to have non-musical children; those parents, one of whom is musical with musical ancestry, the other non-musical of non-musical ancestry, have children of both types.[1]

DOES PRACTICE OR TRAINING LESSEN THE DIFFERENCES?

The cases cited in the previous chapter dealt mainly with experienced, or, in other words, practiced or trained persons Still the differences persisted. This is fairly conclusive evidence that the differences are not eliminated by practice.

Dr. F. L. Wells[2] experimented upon ten persons for 30 days. During this period they practiced at addition and at a number-checking test. It was found that the persons who did well in the test on the first day did well after 30 days of practice, while those persons who did poorly on the first day also ranked low at the close of the practice. Dr. Wells says, "superior performance at the beginning of special practice is not necessarily, nor even probably, attained at the sacrifice of prospects for future improvement."

Other experiments performed by Dr. G. S. Gates of Columbia University have given similar results. Dr. Gates experimented upon twenty-three women who practiced from twenty-two to twenty-nine times on each of the six tests. She states: "Records

[1] STANTON, DR. H. M., "Psychological Monograph," vol. XXXI, No. 1.
[2] *American Journal of Psychology*, p. 75, 1912.

made near the beginning of practice are indicative of future proficiency."

Almost all scientific investigations that have been made in this connection tend toward the same conclusion, namely, that *individual differences are not lessened by practice.* In fact it may be very likely that the differences are increased by continued practice. This latter condition—which is a probability rather than a mere possibility—is indicated in Fig. 36, in which it is seen that the proficiency of the better man increases more rapidly than that of the one whose initial performance was poorer.

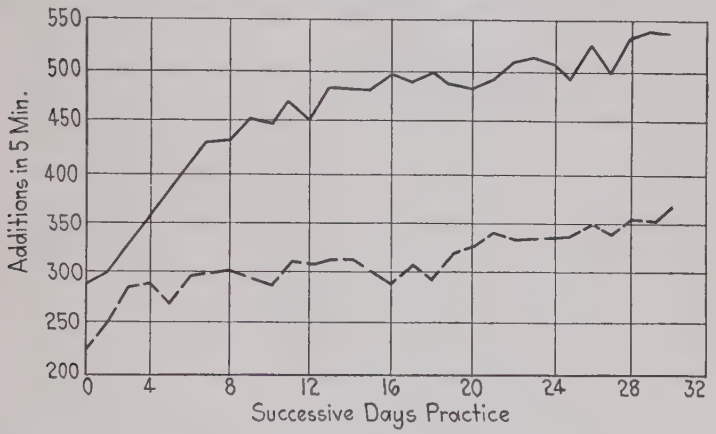


FIG. 36.—Continued practice does not lessen individual differences, in fact, it oftentimes increases them as this chart shows. Differences are not likely due to practice but to the capacity to profit by practice. (*Data from Dr. F. L. Wells.*)

Unfortunately, there is little available data concerning the actual relations between initial ability and final ability under the conditions prevailing in industries. It is highly desirable that such data be recorded. Most of the accurate data available are for a limited group of subjects in limited tests over a relatively short period, such as 30 days. There is no information that would make one believe that results under actual working conditions would be different but, until actual data are produced, there will be a gap in the definite knowledge on this point.[1]

[1] The author would be glad to cooperate with any industry which keeps its piecework records, and in which there are operations in which maximum productivity is reached only after several months, or even years of experience in making a scientific study to determine the facts with reference to the actual conditions in industry.

Ordinary methods of training, apprenticeship, and instruction probably can do no more than show each individual the best or the accepted way of using his abilities. It is extremely doubtful whether this training will alter the native abilities at all.

The data and opinions that have been reviewed undoubtedly have given a fatalistic turn to the belief that individual differences might be corrected. In some respects their doing so is unwarranted. A distinction must be made to help clear away too fatalistic an interpretation and, at the same time, to clarify some apparently obvious objections to the general proposition that all individual differences are largely inherent in the individual and are in no wise a product of his environment and his training.

A distinction must be made between *capacities and abilities.* From the practical point of view, the most patent difference between a telegraph operator and one who is not is in the matter of training. The operator has been practiced in the telegraph code, in receiving and sending, in making reports, and in all the routine details connected with his work. This is obviously the result of training. The telegraph operator's son differs from the blacksmith's son in his knowledge of telegraphy because the former's father talks code and shop and, in this way, the boy has picked up some acquaintanceship with the subject that the other boy has had no opportunity to glean. *Abilities* or *skills* may be properly used for such cases as these, for the modification of individuals by their environment as in learning a trade or acquiring habits. The machinist *appears* to be different from the electrician in nature largely because the training of each has been in different trades. As a matter of fact, it is almost entirely in skills that they may appear to differ and these are, to a considerable extent, the result of training.

When the abilities of two machinists who have had similar training are contrasted, it becomes necessary to recognize the influence of differences that were born in the individuals. These differences should be properly termed *capacities.* With the same amount of training, one man is a better worker in a certain line because he has more aptitude, or a greater inborn capacity for that work. Skills are limited largely by these capacities. The illustrations and data that were given earlier in this chapter were limited to individual differences in capacities. We have found that training does not alter the capacities of individuals; the bright stay bright, the dull remain dull, the bungler continues

his bungling and the fast worker shows no decrease in speed. Training does not alter these capacities.

Skills, or abilities, on the other hand, are the product of capacity plus training. Many persons have the capacity to be skilled diamond polishers but, being deficient or wholly wanting in training in that work, their abilities may be demonstrated to be close to zero although their capacities may be very high. At the same time, all diamond polishers—or lathe machinists, or inspectors, or loom workers—with the same amount of training and experience, do not make equally skilled workers. This is because some workers, prior to all training and experience, have been endowed with greater capacities for the work than others, and a lifetime of experience cannot alter their nature. *Skills, or abilities, are the result of the action of training or experience on capacities in which individuals differ greatly and unchangeably.* Capacities are the result of an individual having the particular parents he has.

Two distinct lines of activity in employment psychological methods follow from this variation in individual differences. In the selection of workers with no training, the task becomes one of *measuring* capacities. The emphasis is placed upon measuring because, from what is known of the nature of individual variations, one must not look for differences in the kinds of qualities possessed, but rather for differences in the amounts possessed. Capacity tests are distinguished from ability tests. Examples of ability tests are found in prevailing employment methods where the applicant is asked how to proceed to do certain operations or is given a turn at the machine. The more scientific application of ability tests is seen in the development of *trade tests.*

Earlier in this discussion, the terms ability, skill, and capacity have been used indiscriminately. This has been done largely to avoid the monotonous reiteration of capacity. From this point on, however, it will be necessary to watch carefully the use of these terms, and notice whether capacity is used in describing differences that are altered or increased by training. To a certain extent, however, this may give a false impression of the functions of employment psychology. Because the treatment of topics is sharply differentiated, it does not necessarily follow that, in practical employment situations, one should be in search of either capacities or of abilities. The capacities as well as the abilities of every employee should be known. In well-developed

employment policies, the two go hand-in-hand and workers are placed not only by abilities but by their capacities as well.

THE ORIGIN OF PERSONALITY

The relation of certain mental traits, that are commonly called personality traits or characteristics, remains to be indicated. Intellectual capacities, as has been seen, are not altered appreciably by environment, training, or opportunity. Capacities for musical endeavors, sensory discrimination, and many others are also unappreciably modified by training, environment, and

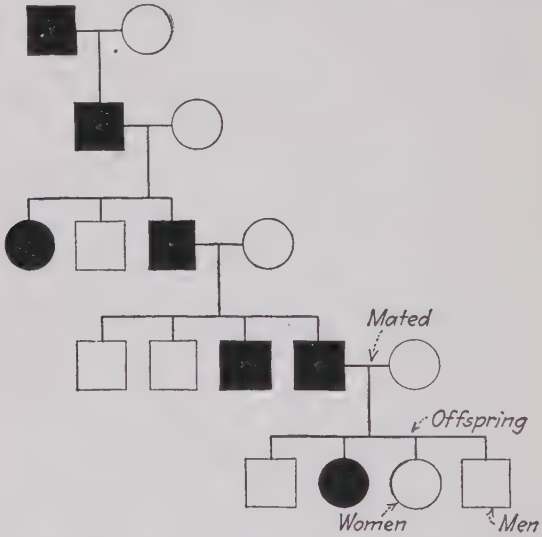


FIG. 37.—How bad temper runs in families. (Explanation in text. *Data from Dr. Charles B. Davenport.*)

opportunity. In turning to personality characteristics such as excitability, poise, irritability, pleasantness, seriousness, happy-go-luckiness, stubbornness, quarrelsomeness, and grandiose ideas, the trend of evidence is found shifting in the opposite direction.

There is some evidence which may be taken to indicate that violent temper and temperaments are inherited according to well-known laws of inheritance.[1] Such a case, traced through five generations, is shown in Fig. 37. The general plan of this figure is the same as Fig. 35. One modification has been made in the use of a solid black symbol for a person with a violent temper.

[1] *Eugenics Record Office, Bull.* 12.

The present generation is at the bottom of the chart. There are four children in this generation, the girl indicated by the solid black, has a violent temper, quite uncontrolled. When angry, she will throw anything she happens to have near at hand at the one who offended her. Her father, (the line above, in black), was ". . . sent to a technological school where he divided his time between reading and women; is a tall, cultured man; has a violent temper, and will throw things on the slightest provocation . . . One brother is a clergyman of high standing; another, a man of excellent intellectual attainments who has the reputation of being quick tempered . . . The father's father is a man of high culture; was formerly professor of languages, and has a violent temper; his sister is a woman of brilliant intellect . . . with such a high temper that she would get into a rage over nothing . . . The father's father was president of a leading eastern university; he had a quick temper but controlled it well. His father had a quick, uneven temper."

There are other lines of psychological evidence which would make it appear that these personality traits are made rather than inborn. It may be that the best employment attitude is to look upon these factors as constituting a middle ground between capacities and abilities.

Capacities cannot be altered; abilities of any degree of skill cannot be built when the capacities are low; personality traits, like abilities in the wrong capacities, can be rebuilt, but this is the task of the mental hygienist in industry. The employment psychologist can select and rearrange men to bring into play those abilities that are equal to and not overtaxing their individual capacities. He can aid, to a considerable extent, in remaking undesirable or unhealthy personality traits. In both he is limited by his own capacities and training. His training is a matter of environment and opportunity; his capacities are the fundamental man, unalterable and persistent, limiting the usefulness of his training and ultimately manifesting themselves in his abilities. Training can be guided by man and molded to suit conditions; capacities have to be taken as they are. They cannot be changed to meet the whims of maiden aunts and expectant parents. The training should be determined by the capacities that are evident, or we see later the spectacle of a 22-caliber rifle trying to discharge a 16-inch projectile.

Dress a dog up, put a pipe in his mouth, but he is still a dog. Put evening clothes on a monkey, train him to eat at a table, but he is still a monkey. Train diligently a worker with meager capacities and he remains only a mediocre worker.

In India the natives have an oppressive caste system. If the religious discrimination is eliminated, the social ostracism, and the denial of the equality of opportunity, there is much justification for an industrial caste system. Occupational capacities are obtained from one's ancestors, and their pursuit would probably operate to the best advantage of the individual and of society. In spite of this, a highly efficient loom worker is found, with generations of skilled loom workers before him, saving and stinting that his boy may be educated to be an attorney, a physician, or a clergyman. An industrial utopia must be created in which the rewards of the loom worker will be as enticing in such cases as the rewards from other occupations, else weaving will suffer and other occupations will be overmanned.

In hundreds of application blanks and personnel records, one is yet to be found in which the occupations of the applicant's ancestors were ascertained. Yet this information would tell more about his fitness than all his letters of recommendation. The employer hires the worker's family as well as the worker himself.

SUGGESTED READINGS

THORNDIKE, E. L.: "Educational Psychology: Mental Work and Fatigue and Individual Differences," 408 pp., Teachers' College, Columbia University, 1914.

WALTER, H. E.: "Genetics: An Introduction to the Study of Heredity," 272 pp., The Macmillan Company, 1913.

POPENOE, P. B.: "Applied Eugenics," 459 pp., The Macmillan Company, 1918.

DAVENPORT, C. B.: "Naval Officers, Their Heredity and Development," 236 pp., Carnegie Institution of Washington, 1919.

CHAPTER V

THE LETTER OF APPLICATION

It now becomes necessary to review critically the commonly accepted methods of detecting individual differences. Traditional methods of selection have had a haphazard, rather than a scientific, development. Before all our faith is placed in them or they are discarded, they must be studied to determine their relative and, in so far as possible, their absolute values.

Workers are employed on the basis of one or more of the following criteria: Letters of application; photographs; interviews; a trial at the work; recommendations; so-called "character analyses," and even the horoscope has been taken into consideration in some instances. For the more responsible positions information may be obtained from all these measures, but oftentimes in the selection of semi-skilled or unskilled workers only the method of the interview is used. Every firm places varying amounts of reliance on the different criteria. For the present, however, no attempt will be made to state how much weight should be given to the different elements in selecting workers of different levels. What precedes this logically is a careful survey of the justified usefulness of each of the criteria.

BASIC PRINCIPLES IN JUDGING TESTS

The principles that guide the physicist in constructing tests for the Bureau of Standards are no different from those to be followed in employment testing. There are three cardinal principles to be used as a guide in all testing, regardless of its nature. These three principles are the ones to be followed in scientifically evaluating any work, or any conclusions that should possess more than merely chance value.

1. The Test Should Be Reliable.—A measure is reliable if one qualified user of the measure obtains consistent results with a given group of employees on two or more occasions, each time being ignorant of his previous measure of the employees. The Orsat test for carbon dioxide is reliable because any single quali-

fied analyst, in measuring a sample of air, will obtain almost identical results each time it is employed, regardless of how many times he analyzes it. Grades of success on a civil service examination in mathematics, however, are not reliable since it has been found that, if several papers are duplicated in a batch of a hundred or more, widely differing grades will be given to the same paper disguised only in penmanship and the name of the examinee.

Employment measures are not always reliable as will soon be found. If they were absolutely reliable, each applicant would be given the same preference every time he was interviewed. A test is not reliable if Jones is tested on Monday and found to be of average intelligence, and tested again on Friday and found to be of superior intelligence. Intelligence tests do not change

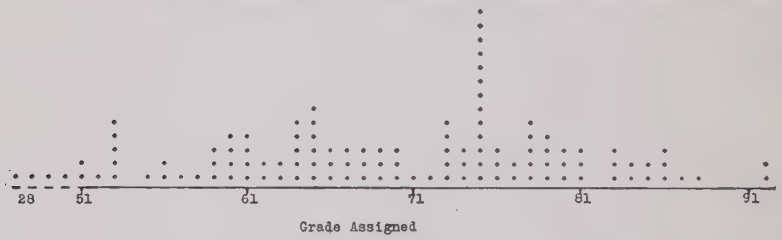


FIG. 38.—Some civil service marks may have reliability, but there is a need for caution, as this chart of the grades assigned to a *single paper* in mathematics by 114 experienced graders reveals. A dot indicates a grade by one examiner at the point indicated along the base line.

that way from trial to trial. If they did, could any faith be placed in their results? If any test, or measure, or opinion does not give almost exactly the same result each time it is applied to an individual, can more reliance be placed upon it than upon flipping a coin?

Reliability, as applied to testing and measuring, means consistency. The best way to discover this is to find out whether each time an employee is measured by one test he makes almost exactly the same score. If he does not, the test is valueless for any purpose but as a puzzle.

The first thing to ascertain about a criterion of selection is: Is it reliable? Will it consistently agree with itself? This cannot be answered by looking casually over the pages of the test; it must as a rule be done empirically. This can be done by: (1) Actually re-testing persons from time to time and comparing their scores; (2) comparing a person's standing on the first half of

a test with his standing in the second half; (3) computing one score from the even items, and another score from the odd items, and comparing these.

One can compare the standing of each person tested in the first half of the test with his standing on the entire test. If it is found that those ranking highest in the first 10 minutes ranked highest in the entire hour, and that the others are arranged accordingly, one will be justified in inferring that the test tried has more reliability than a test that did not agree so closely with itself.

Another way of arriving at the reliability of any measure of human character is to give an estimate of the characteristics under discussion on a certain day, and then a month later to give a second estimate or grade. If these agree closely, more reliability is inferred than if successive estimates did not place the same person on about an equal plane.

A third method of determining the reliability of employment estimates or measures is to have two different tests which are assumed to measure the same characteristic and compare the results. Thus the reliability of the army intelligence tests was determined, in part, by the agreement of five different forms of it with each other. Regardless of which form was used, the men received about the same score in each test. This indicated a great amount of reliability, just as the measuring instruments used in a plant, such as micrometers or rules, are reliable only when they agree with each other. Another illustration from engineering can be drawn from ammeters or pressure gages that are reliable only in so far as they agree with each other in determining electrical or steam pressure. If, with the same head of steam, the engine-room gage reads 160 pounds and another gage attached to the same line reads only 150 pounds, their reliability is low. In human engineering the same factors must be taken into account. All mechanical gages and instruments used in most plants agree closely with each other. Do the criteria on which workers are selected agree with each other from plant to plant or even within the plant? There will be some startling revelations to make in answering this question.

2. The Measure or Test Should Be Objective.—The measure or test is objective only when different users apply it to the same persons and the scores or measures obtained are practically identical. It is subjective when Mr. A. and Mr. B. get different

results when testing Mr. Jones. Jones has the same abilities and capacities regardless of who is testing or examining him. If these examiners do not agree, it is evident that one or the other, or both, is not making a true measure of the person under observation.

How objective is a thermometer? Not absolutely objective, because different observers agree closely, but not perfectly, if the readings are to the tenths of a degree. It is probably safe to place the objectivity of temperature readings on a good grade instrument at 98 per cent better than chance.

How objective is the usual employment procedure? It is not necessary for us to guess at the amount of objectivity of any of the different criteria. This can be determined with mathematical exactness. An illustration will make clear how this is accomplished, as well as the significance of the degrees of correspondence. Imagine a plant that has two employment managers who interview and select all workers. Assume that for the purposes of a test of the reliability of this method of selecting workers, both interviewers have passed judgment upon five applicants. Each one has interviewed the five applicants and has rendered his judgment in the form of a list of preference. At the top is given the name of the candidate he considers to be best fitted, followed by the name of the second best candidate, and so on for all five. The following table will represent the situation that might be found to exist when the rankings of the two interviewers are compared:

Applicant	Rank by interviewer J. K.	Rank by interviewer H. Y.
Green	1	1
Smith	2	2
Miller	3	3
White	4	4
Jones	5	5

This would indicate prefect agreement in the selections of the two interviewers. In practical situations, however, such agreement is rare. More often one finds results like the following:

Applicant	Rank by interviewer J. K.	Rank by interviewer H. Y.
Green	1	3
Smith	2	4
Miller	3	1
White	4	2
Jones	5	5

In such a case as this, it is difficult to tell by inspection just how close the agreement is between the two employment managers. Accordingly, the methods that have been devised by mathematicians for measuring the degree of relationship, or the amount of reliability, must be employed.

A convenient formula for use is the "foot-rule" formula of Professor Spearman which is:

$$\text{Relationship} = 1 - \frac{6 \times \text{sum of the gains}}{\text{Number of cases squared, minus 1}}.$$

In the hypothetical data above, the sum of the gains in rank are as follows:

Green	0
Smith	0
Miller	2
White	2
Jones	0
Sum of the gains	4

Working the formula further:

$$\text{Relationship} = 1 - \frac{6 \times 4}{(5 \times 5) - 1},$$

or

$$\text{Relationship} = 1 - \frac{24}{24},$$

or

$$\text{Relationship} = 1 - 1, \text{ or } 0.$$

It thus turns out that mathematically the illustration shows no relationship between the grades given by the two interviewers. If such instances were found in actual industrial conditions, they would indicate a low reliability for interviews as a method of selecting workers.

If there had been absolute agreement, as in the first arrangements, the relationship would have been +1. In arrangements

where the rankings of one interviewer are the exact reverse of those given by the other, the relationship is -1. A relationship of zero such as was obtained in the second illustration means no relationship at all; a relationship of $+1$ means perfect agreement; a relationship of -1 means complete disagreement.[1]

3. The Measure or Test Should Be Valid.—A valid measure is one that measures what it has been constructed to measure. A foot rule is not a valid measure of the boiling point of water nor is an ammeter a valid measure of length. An Orsat test for carbon dioxide is reliable and objective. As a rule it is valid, but at times its validity is lost since alcohol vapor is registered the same as carbon dioxide in the detecting solutions. When alcohol is present in the atmosphere being studied, the Orsat test is not valid because it is not measuring what it purports to measure.

Employment interviews and allied methods try to ascertain whether or not an applicant is suited for a certain position. Many of these selections are not valid; 40 per cent of discharges are due to workers not being adapted to their work. Many other selections are not valid, the worker leaving before he receives a bad recommendation by being discharged for inaptitude. Thus one linotype operator sets only half as much type as another with the same experience and similar opportunities; one consol laster turns out half as many pairs of shoes per day as does another.

A method may be reliable, that is, agree closely with itself, but still be lacking in all validity. Any method used to select stenographers should, to be valid, do so with a high degree of accuracy. Voltmeters and ammeters, to use an electrical analogy, have high reliability, but the validity is extremely low if one uses a voltmeter to measure humidity. It is obvious that in mechanical tests and methods the validity is usually high; in employment procedure, the validity is usually very low.

One may obtain a measure of the validity of various methods of selecting workers in some such fashion as this. Imagine that five typists are being employed. Twenty-five have applied for the position. Assuming that all are of equal experience and all have equally good letters of commendation, have them copy two typewritten pages as an employment test to determine which ones should be chosen. If those who type the two pages in the

[1] Apparent exceptions to this are explained in chap. XI.

shortest time and with the fewest errors are employed, one would obtain what would reasonably appear to be the five best typists out of the group of applicants. So far, the validity of the method has been assumed. But how valid is it in terms of the per cent better than chance? May it not be that such a method is also, to a very large extent, a test of the way in which the applicants can be discomposed, or embarrassed, or of their condition of fatigue?

The degree of validity of a test, or of an employment method, can be determined mathematically just as is its reliability. The applicants' scores in the preliminary two pages of typing should be compared with the scores in similar work taken under the actual working conditions of the organization after 1, 2, or 6 months. Using the same formula that was previously employed in obtaining the degree of relationship and ranking the typists in initial ability in the two-page test and in ability after 6 months' service, one can obtain a measure of the validity of the method. The traditional employment methods will now be taken up in turn, and the findings relating to the validity and the reliability of each discussed. General considerations based upon common sense will be passed over with brief mention.

THE RELIABILITY OF LETTERS OF APPLICATION

Two noteworthy studies have been made of letters of application. Miss L. C. Walton, at Columbia University, received over 100 letters in response to a want-ad, for a bookkeeper and office assistant, that was inserted in one of the New York Sunday papers. Each applicant for the *bona fide* position used his own judgment in producing his letter of application. These letters were then passed upon by several groups of persons acting as prospective employers. A group of business persons whose weekly work was spent partly in choosing applicants from just such letters, and a group of miscellaneous persons, carefully perused the letters and arranged them in the order they thought the applicants were fitted for the work.

After a lapse of a month, some of the judges again rated the same letters in the order of merit of the applicants. When these two ratings are compared, some insight into the reliability of such estimates will be obtained. The following degrees of relationship between the two series of judgments were found:

RELIABILITY OF JUDGMENTS BASED ON LETTERS OF APPLICATION IN THE CASE OF TEN JUDGES. CORRELATION OF FIRST WITH SECOND JUDGMENTS[1]

Judge	Intelligence	Tact	Reliability	Neatness	Average
Jones	0.59	0.40	0.50	0.67	0.54
Gluek	0.72	0.72	0.73	0.72	0.72
Loeb	0.08	0.40	0.27	0.38	0.28
Kelley	0.72	0.44	0.65	0.88	0.67
Beers	0.60	0.63	0.20	0.44	0.47
Scott	0.31	0.18	0.23	−0.14	0.21
Knight	0.44	0.52	0.46	0.92	0.60
Moore	0.62	0.31	0.45	0.51	0.47
Smith	0.65	0.71	0.73	0.91	0.75
Brown	0.63	0.42	0.52	0.71	0.57
Medians	0.61	0.43	0.48	0.69	0.55

[1] Spearman's method; see chap. XI.

The average coefficients of 50 business and professional men in this experiment were as follows:

	Average	Highest	Lowest
Intelligence	0.54	0.91	0.14
Tact	0.47	0.91	0.31
Reliability	0.47	0.93	0.34
Neatness	0.60	0.99	0.24

These findings take on greater significance if converted into the per cent better than chance reliability they indicate.[1] This is shown in the following tabulation:

	Average, per cent	Highest, per cent	Lowest, per cent
Intelligence	36	58	2
Tact	28	58	5
Reliability	28	62	6
Neatness	48	86	3

[1] See Fig. 110.

Figures 39, 40, and 41 show how high, how low, and what average reliability may be expected. On the whole, the relia-

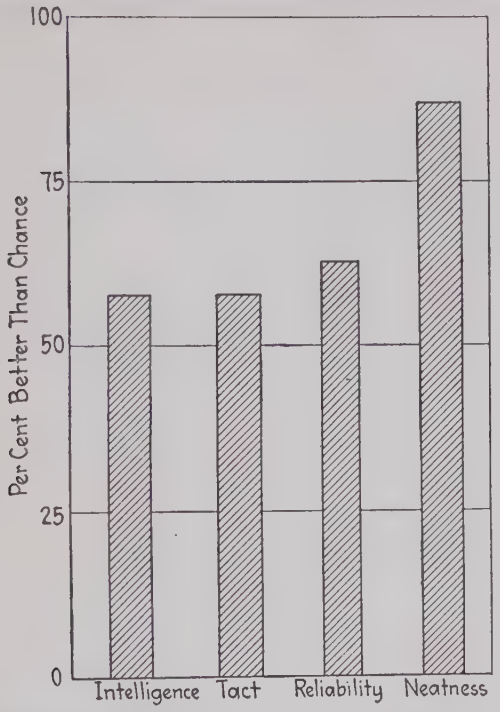


FIG. 39.—The highest reliability discovered in judging applicants from their letters is shown by these bars.

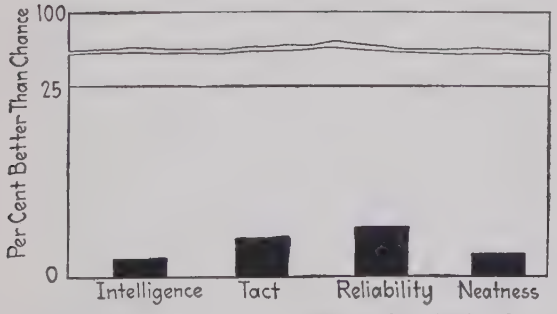


FIG. 40.—How close the poorest of 50 business and professional men are to zero reliability in estimating the four traits from letters of application. (*Data for Figs.* 39, 40, *and* 41 *from Miss L. C. Walton.*)

bility averages about 35 per cent better than chance alone when a large group of persons have carefully selected the letters. This

does not consider the validity of the method at all. It is not known, as yet, whether the person rated high in tact or neatness was really very tactful or very neat. The above figures refer only to the consistency of the persons in making selections from letters of application.

Not all judges appear to be equally reliable in such selections. Mr. Smith exhibited *fairly* reliable arrangements in the two

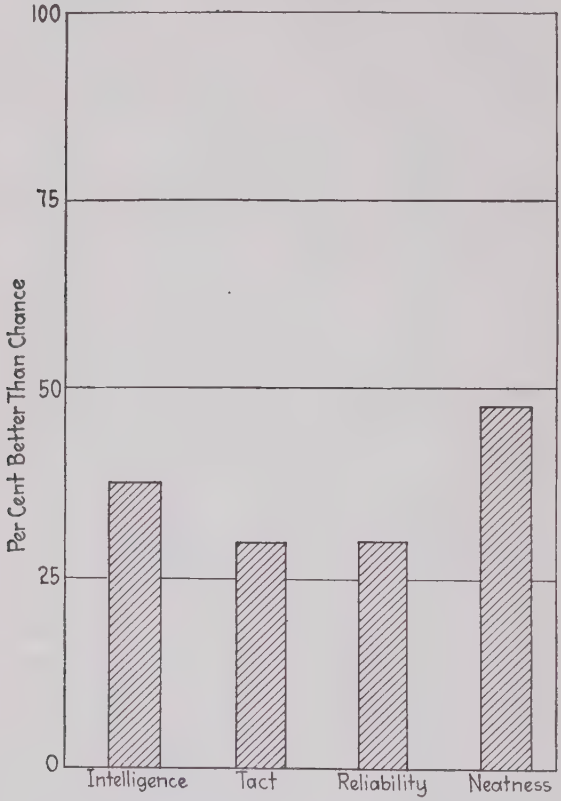


FIG. 41.—The average reliability of 50 business and professional men in estimating the traits indicated from letters of application.

studied. Mr. Scott's arrangements were of no useful reliability, and Mr. Moore was less reliable in estimating tact than in estimating the other traits.

The present data, which are limited to only two arrangements, might be interpreted as indicating that some persons are naturally more reliable in selecting applicants from letters

than are others who are assigned the same task. Personally, I doubt if such is really the case. In connection with photographs, data which will be cited will show plainly that the person who appears to have great ability in one or two arrangements will fail utterly if the number of arrangements is increased, indicating that one or two reliable arrangements may be the result of chance alone. In judgments such as these, the "general expert," either by nature or training and experience, is largely an illusion.

Striking insight into the lack of objectivity to which selection from letters is subject is given by studying the levels assigned to one letter by the different judges. The following data show the wide range in which a single applicant may be placed—or more properly, *mis*placed—when his characteristics are judged from the letter he writes in applying for a position. The ratings by ten judges of a letter chosen at random show that it was placed as follows, when 1 would be highest and 25 lowest:

Intelligence	6, 13, 2, 11, 9, 17, 3, 4, 11, 3.
Tact	10, 17, 2, 23, 10, 13, 5, 4, 10, 16.
Reliability	6, 17, 9, 17, 19, 12, 5, 4, 11, 5.
Neatness	7, 13, 1, 11, 13, 8, 11, 4, 10, 9.

In this particular letter, the applicant was rated second in intelligence (on a basis of 1 to 25) by one judge, and seventeenth by another judge. Similarly, the same letter that was rated second in tact by one judge received a rating of twenty-third by another. The objectivity is scarcely 10 per cent better than if the judges had arranged the letter with their eyes closed. It is safe to conclude that employees selected primarily on the apparent merits of their letter of application have been chosen scarcely more objectively than if the first five who appeared had been employed.

THE VALIDITY OF SELECTIONS BASED ON LETTERS OF APPLICATION

There are several lines of evidence relating to the validity of letters of application in employment selection. The estimates of *tact* from the letters are available, and, from those who know the applicants intimately, estimates can be obtained of the tact they possess. By comparing the degree of relationship between the estimates of acquaintances and from letters, an index of the validity of the latter estimate can be approached. It should not be ignored, however, that, while the estimate of acquaintances is

undoubtedly more nearly correct than the other estimate, it is probably not especially valid in itself. It is another instance of the blind leading the blind but, in the last analysis, it is the nearest valid approach one can make at present to the measurement of this trait.

When the estimates of persons intimately acquainted with those who have written letters are compared with the estimates arrived at by strangers, the degree of relationship, shown in Fig. 42, has been discovered by Dr. A. T. Poffenberger.

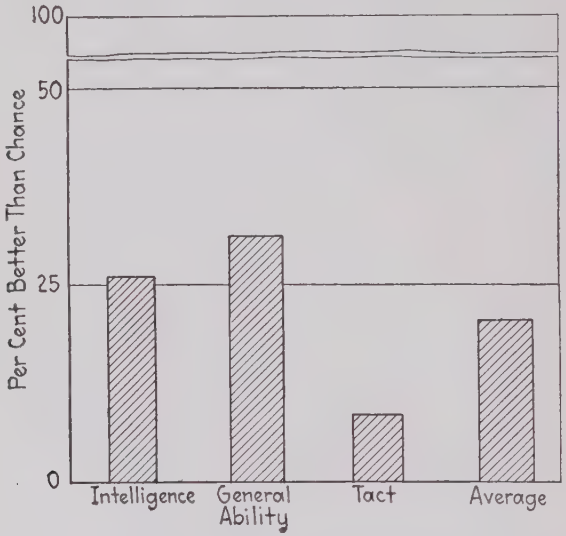


FIG. 42.—The validity of estimates from letters of application averages about 20 per cent better than chance. (*Data from Dr. A. T. Poffenberger.*)

The validity of this method is thus found to be even less than the reliability; the validity being about 20 per cent better than would be due to chance alone.

When the estimates of several persons on the letters are combined to give a group judgment, the validity is raised slightly but not enough to justify the additional time and effort. The inaccuracy of combining the estimates of even as many as fifty judges on twenty-five letters is evident when it is discovered that the average position given to one of the letters may be as many as five places from the true.

The preceding paragraph refers only to instances where each of the judges reaches his conclusions independently of the others.

It might be that when several judges meet together and reach their decisions, the validity would be increased, but experiments where this has been done on similar estimates have disclosed no improvement. What usually happens when a group works together in conference is that the more aggressive or prominent or influential member of the committee dominates, and the final decision is in reality more the decision of an individual than it is of the group.

The low validity of estimating fitness for positions from letters of application is also shown by the difficulty of separating tact from intelligence or general reliability in making the estimates. The apparent division of estimates into the different characteristics is highly deceptive. Although one may carefully examine all the letters for tact and go over them again to judge them on the basis of reliability, what is being estimated in both cases is the general impression that is made by the letter. This is true in spite of the best efforts to limit one's judgment to the separate characteristics.

Miss Walton found, for instance, that the degree of relationship between the estimates of the different traits listed was as follows:[1]

Intelligence and tact	0.92
Intelligence and reliability	0.91
Intelligence and neatness	0.82
Tact and reliability	0.91
Tact and neatness	0.85
Reliability and neatness	0.84
Average	0.88

The above figures indicate, beyond doubt, that there is what has been termed a **"halo effect"** in all the estimates. Each letter gives a general impression or halo and, regardless of the name that is given whether neatness, tact, reliability or what not, it is in fact the halo that is being judged. Therefore, although it might be very desirable to know the relative merits of the different applicants in neatness or reliability, it is well nigh impossible to obtain a valid estimate of these traits from the letters. And, although the prospective employer would like to know the relative standings of the candidates in the different traits, it would be more satisfactory to acknowledge openly that the ultra-refinement of the estimates into categories is highly deceptive.

[1] Spearman's formula.

The validity of letters of application is further impugned by the fact that the statements in the letter are presumably the applicant's own estimates of himself. Making all allowances for implicit honesty in these estimates, it is well to recognize that these may be erroneous. This matter will be given more detailed attention later.

DOES WRITING REVEAL CHARACTER?

A phase of the use of letters of application in employment practice that is not to be ignored, but which is somewhat aside from

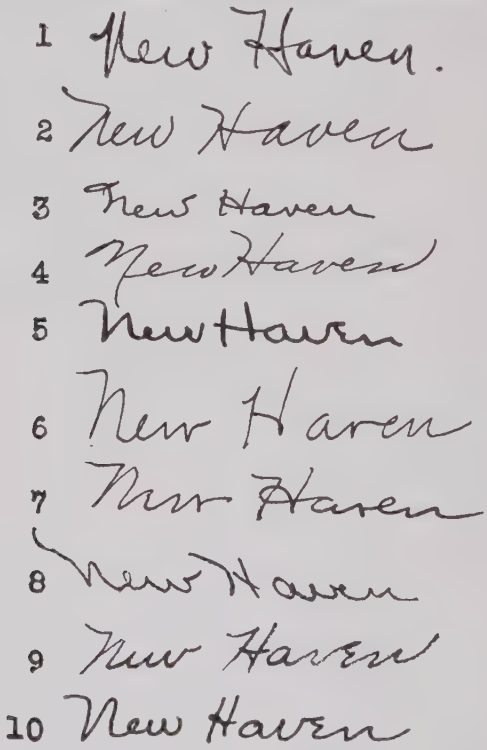
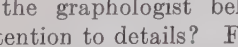


FIG. 43.—Which of these were written by men? (Key at end of chapter.)

the direct question of the validity of the method, should be mentioned at this point. There is an assumption that handwriting reveals certain traits of character or certain abilities. The author knows of one firm whose employment manager will not definitely engage a likely applicant for an important position until a specimen of the applicant's handwriting is examined by a woman who

professes to be able to tell from certain graphic signs if an individual is honest and reliable. Whether or not one goes to such extremes as that of utilizing an alleged expert at reading character from writing, it is commonly assumed that the careful worker, or the neat worker, or the hasty worker can be detected by his handwriting. It is an assumption without any other support than one's own confidence in his "hunches." Handwriting is decidedly individualistic to the handwriting expert. A. S. Osborn of New York maintains that, "the mathematical probability of two complete handwritings being identical is one in something more than sixty-eight trillions."

Elsewhere the author has written:

> Graphologists account for this great individuality by stating that each feature of one's writing reveals certain character points and, since no two characters are exactly alike, their writing also differs in spite of school training in one of the five systems.
>
> If your writing is large and bold these teachings state that that is a sign of imagination, ambition, pride. If, on the other hand, your writing is small, it is a symptom of miserliness, minute attention to details, self-centeredness.
>
> A heavy line in writing is also taught to indicate strength of will, and persistence of purpose; light pressure may be evidence of emotional depression or moodiness. Writing that slants to the right is a sign of emotional susceptibility, impulsiveness, and irritability. Vertical writing is found, presumably, in those with marked self-control and reserve. A slant to the left is an index of the power of concealment and of an unsympathetic nature.
>
> Why does the graphologist believe that small handwriting is evidence of attention to details? From reasoning by analogy. Just as it is also said that the person who crosses his t's in this fashion has a serpentine temperament, or that the person who writes with continuity from letter to letter in words has coherent thought while the one who interrupts his words in this fashion  has flashes of inspiration. The basis for such interpretations as these would appear to be largely analogy. Since scarcely any experimental evidence is submitted by the graphologists, we must assume reasoning by analogy, with all its pitfalls and scientific absurdities.
>
> Similar reasoning is apparently involved in deducing that the penman who makes the stems of such letters as t, d, and f very prominent is idealistic because he has extended the lines heavenward,

as it were, while the other person who extends the p, q, or g distinctly lower than common has base, earthly qualities.

Does this type of reasoning give validity to the interpretations of character from writing? Just as much scientific validity as was given

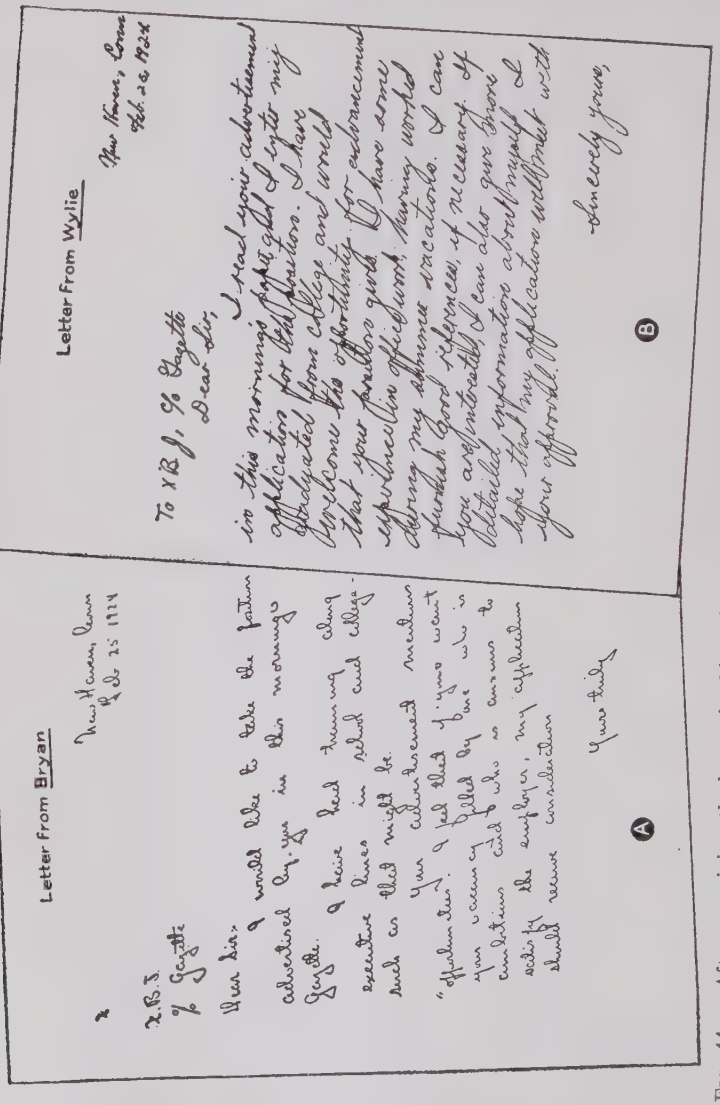


FIG. 44a.—After examining the letters in this and the following figure decide what is the proper order of intelligence for the young men writing them. (Key at close of chapter.)

to medicine when bloodroot was prescribed for the blood because the root had a red juice, or liverwort—since it had a leaf shaped like the liver—was prescribed for diseases of the liver. Analogy is at the

foundation of superstitions and omens; nothing scientific or valid can come from this basis . . .

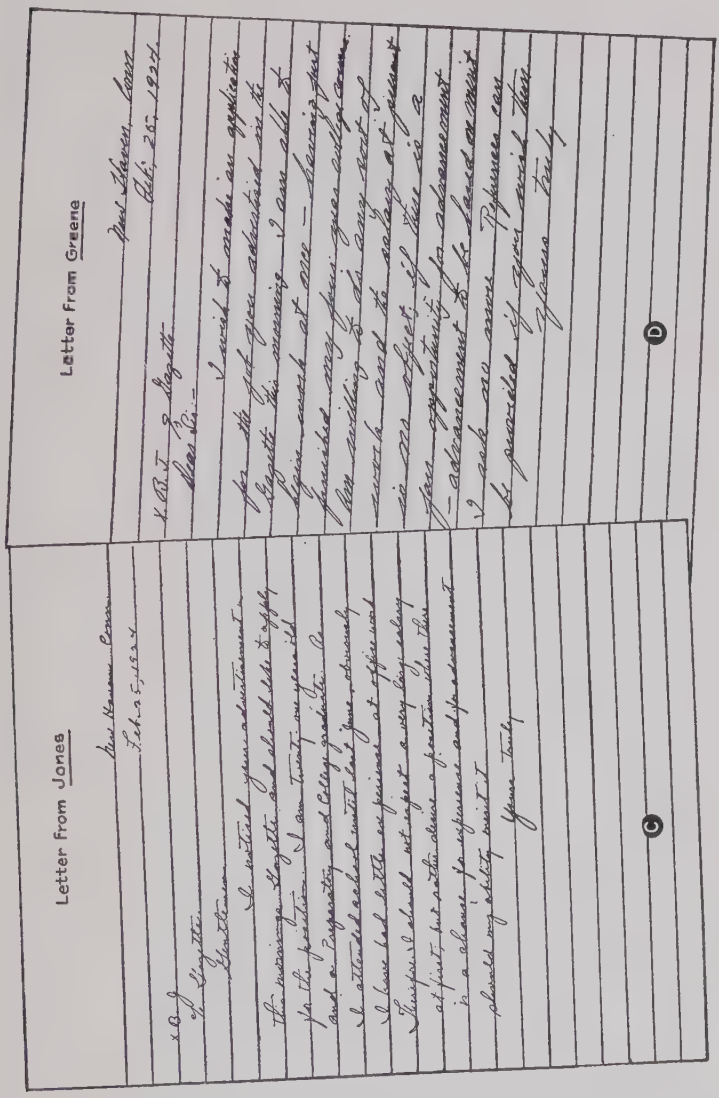


FIG. 44*b*.

A critical check on these teachings has been performed by Professor Clark L. Hull of the University of Wisconsin with the cooperation of Robert B. Montgomery. These experimenters studied the following alleged graphological signs:

Ambition	lines sloping up-hill.
Pride	lines sloping up-hill.
Bashfulness	fine lines.
Force	heavy lines or heavy bars on "t's."
Perseverance	long bars on the "t's."
Reserve	closes "s's" and "o's."

Seventeen members of a medical fraternity submitted to having their writing and character traits listed as above studied. Normal writing of a paragraph from a popular magazine was obtained from each. Then the ranking of each of the seventeen medical students in the six character traits was obtained.

Did the writing give any indication of their character? The medical student who was ranked as the most ambitious had one of the most downward sloping writings, and the most un-ambitious one had the most up-hill writing, just the reverse of what the graphologists would have said from examining the handwriting. A few exceptions however, prove nothing mathematically.

When we consider the degrees of relationship between the character as portrayed by the writing and as judged by the associates of the medical students, the highest relationship found is 0.38. The lowest is -0.20. Two-thirds of them, in fact, are negative, and not a single one indicates that the graphological teachings have any validity at all!

From these and other data:

> . . . we may conclude that there is no indication whatever of these six character traits being betrayed by the signs that the graphologists accept. Perhaps there are other signs that do betray these character traits, but if so, the characterologists are keeping it a secret and careful scientific investigators are unable to discover any.

It is possible for one to tell the sex of a person from his writing in only about 60 per cent of the cases examined, while 50 per cent of the judgments made with one's eyes closed would be correct. The samples of writing reproduced will serve to demonstrate this.

There are no demonstrated scientific methods for measuring character in any way from handwriting. Every bit of scientific knowledge is opposed to the possibility of there being any such system for centuries to come. Nothing could be more unwarranted, in fact, than the assumption that the writing in a letter of application is of any importance in disclosing the applicant's qualifications, other than that it will show the legibility of his writing.

It seems contrary to common sense, however, to insist that neatness in a letter does not also indicate neatness in other respects. But the person with a neat appearance does not invariably turn out a neat letter. In fact, the opposite is commonly the case. And a neat letter of application does not necessarily mean that the applicant writes a neat letter to her fiance or keeps books neatly.

> At the Montana State Normal College careful experiments were undertaken to determine whether the habit of producing neat papers in arithmetic would affect the written work in other studies . . . The results are almost startling in their failure to show the slightest improvement in language and spelling papers although the improvement in the arithmetic papers was noticeable from the first.

What is true for neatness holds for other characteristics. The person who reasons carefully in financial matters does not necessarily exercise his "faculty of reasoning" when he is concerned with matters of religion or science. He does not exercise it because he does not have it. There are no "powers of the mind" such as reasoning, remembering, and such. This is not to deny that one does reason or remember. The point to be made is that, if there were such powers or faculties, one with well-developed reasoning would reason equally well in all fields, or one with a strong memory would remember equally tenaciously all subjects. Everyday observations—such as the person who can remember names but not faces, or the person who can remember all the bridge cards that have been played but forgets that he plays next—illustrate the absence of any generalized faculties or powers of the mind.

If neat employees are wanted, the way to ascertain whether or not they have that quality is to look at their appearance and not their letter of application. Similarly with honesty, or whatever character trait is considered important. A man may have perseverance in a poker game but not in swinging a reluctant customer. He may be progressive in shop policies and a reactionary in politics. The all-around honest, neat, progressive, or ambitious person is largely a creature of fiction. All have their strong and their weak moments in each of the traits, and a letter of application can reveal only their honesty, perseverance, or ambition in writing a letter of application.

The letter of application, as ordinarily used, should not be relied upon to do more than bring to the prospective employer the names and addresses of interested candidates. It is capable of such modification, however, as to render it of almost as much service as the best interview in selecting workers. This will demand attention in a later chapter.

Key to Fig 43: Lines 3, 5, 7, 9, 10 were written by men; the others by women.

Key to Fig. 44: A test of the writers of these letters showed Greene to be the most intelligent, Jones second, Wylie third, and Bryan the least intelligent.

CHAPTER VI

THE INTERVIEW

A survey of thirty firms employing 55,000 persons made by the Vocational Bureau of Boston disclosed that twenty-one firms always made use of an interview in selecting workers; three usually used this method, and six selected a few of their personnel through this channel.

The employment procedure most used is the personal interview. After the applicant's past industrial history has been obtained, after his recommendations have been examined, after everything else has been considered, the final summing-up of his fitness for the job seems to be settled in most cases by a personal interview. For the less responsible positions all that is commonly used in selecting applicants is the personal interview.

In reply to the question, "Of all the means you use to size up candidates for positions, in which do you have the greatest confidence?," the responses of employers have not been so uniform. Some employers place the interview first in importance; others place the letters from the previous employers first; and some place the most reliance on the applicant's previous industrial experience. Only one instance has been noted, however, in which the personal interview was placed lower than second place by employers and employment managers.

There must be reasons for this consistent use and faith in the employment interview. There are three that play the more important rôles in perpetuating this practice.

First of all, there is a *convenience* to the personal interview that is absent in most of the other employment practices. When this is used as the principal or only method of selection, there are no bothersome in-between steps to be taken, no past records to be examined, no previous employers to consult; nothing to do but look at the man, talk with him a few moments, and then either engage or reject him.

The *speed* with which new employees can be secured is another feature of the personal interview. When the less skilled workers are wanted, they are usually wanted as quickly as possible.

An advertisement in the morning paper will bring a flock of applicants by 10 o'clock, and in ordinary labor markets the men needed will be on the job at that time.

By far the most important reason, however, for the prominence given the personal interview is *the confidence that each of us has in our ability to size up a man through observation and conversation.* Getting the "right slant" on an applicant is, after all, the principal aim of employment selection. And it is largely because of the common belief that as much or even more knowledge can be gained of the candidate's fitness from the interview than from the records of his past industrial history, that the interview occupies the keystone position in employment departments of modern industry.

Let us now take the personal interview into the laboratory, analyze it, and test it in several ways to ascertain if it is deserving of all this confidence. If it is not, this testing process must be continued until its weak spots are located, and means are found of devising a factor of safety that will bridge over the weak spots and convert the ordinary interview into a more reliable and more useful method of determining who shall and who shall not enter different occupations.

If your plant is engaged in providing steel or iron for other industries, you are assured of the standard quality of the product by tests made on representative samples of each pouring. Chemists are used to analyze these samples. The important thing for us to remember now is that, regardless of how many chemists analyze a sample for sulphur or other impurities, their analyses will agree to a fraction of a per cent. If these analyses do not agree, one begins to doubt the objectivity of the tests that are used or the ability of some of the chemists to perform these tests accurately.

The situation is the same if one takes a critical attitude toward the personal interview. The interviewers are the chemists who are making analyses of human abilities. It is reasonable to expect, in fact to demand, that there be a close agreement between the analyses of different interviewers. How close this agreement is, the following experiments will reveal:

THE OBJECTIVITY OF THE INTERVIEW

Twelve sales managers with considerable experience in selecting representatives by personal interviews took part in the

experiment. Each of these sales managers interviewed fifty-seven candidates for a sales position. In this interview each manager used whatever means he wanted to use, or had been in the practice of using, in sizing up the candidates for his sales force. These managers were the analysts of the ability and fitness of the fifty-seven candidates. Did these twelve analysts "agree to a fraction of a per cent?"

Each sales manager arranged the candidates according to his analysis of their fitness. The candidate who, after the interview was completed, appeared to the individual manager to be the best material was ranked first; the next best in the manager's estimation was ranked second; and so on down the scale until the poorest fitted candidate was ranked fifty-seventh. When we compare the rankings of the twelve sales managers, we can obtain some insight into the objectivity of this method.

The following table shows how lacking in agreement these interviewers were. Take the candidate Jones, for example. Mr. Riley, sales manager for one firm, rated this applicant as best out of the half hundred he interviewed. Mr. Moore, sales manager for another firm, rated the same candidate for the same position as one of the worst in the same group of applicants.

THE FINDINGS OF A TEST OF THE PERSONAL INTERVIEW

This table shows the ranks, from 1 to 57, assigned to ten applicants for a sales job by twelve experienced sales managers.

Applicant	Sales manager											
	Mr. Pike	Mr. Able	Mr. Uhle	Mr. Smith	Mr. Brown	Mr. Hart	Mr. Mott	Mr. Moore	Mr. Kelly	Mr. Sinks	Mr. Watts	Mr. Riley
Garfield	33	46	6	56	26	32	12	38	23	22	22	9
Murray	36	50	43	17	51	47	38	20	38	55	39	9
Craig	53	10	6	21	16	9	20	2	57	28	1	26
Willis	44	25	13	48	7	8	43	11	17	12	20	9
Brooks	54	41	33	19	28	48	8	10	56	8	19	26
Irving	18	13	13	8	11	15	15	31	32	18	25	9
Morris	33	2	13	16	28	46	19	32	55	4	16	9
Jackson	13	40	6	24	51	49	10	52	54	29	21	53
Rider	2	36	6	23	11	7	23	17	6	5	6	9
Jones	43	11	13	11	37	40	36	46	25	15	29	1

In the case of candidate Clark, the differences between the findings of the personal interviews are still greater. Mr. Watts rated him best and Mr. Kelley rated him worst. Which one is right? It is difficult to tell from the results of these twelve interviews since none of the twelve judges agree.

Further insight into the lack of objectivity of the personal interview is gained if we obtain the degree of relationship between the selections of one judge with those of another judge. Thus, if we compute the coefficient of correlation between the choices of Mr. Smith and Mr. Able, we find the figure to be 0.26.[1] A coefficient must be as high as 0.50 to indicate an agreement of as little as 13 per cent better than chance. The figure obtained of 0.26 is scarcely 4 per cent greater than would have beed found if the ten men had been assigned numbers, these numbers shuffled in a hat, and then drawn with the eyes closed. It is evident that the objectivity of these interviews is as good as zero!

THE VALIDITY OF THE INTERVIEW

Dr. Walter D. Scott has reported somewhat similar experiments which have added value since the twelve men interviewed were

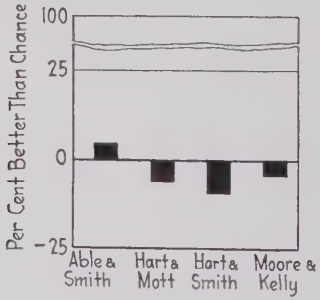


FIG. 45.—These bars show how much greater than chance is the objectivity of interviews.

rated by their actual production record, as well as by the opinion of the interviewer. This is concerned with the validity of the interview. In the following, we have presented the results of three of the interviewers. This table shows that, according to production, Salesman Holly ranked first, Brown next, and so on, with Cole having the least sales.

[1] All correlations from this point on are product-moment.

How Successful Three Executives Were in Selecting Salesmen in a Personal Interview

Salesmen	Rank in production	Rank assigned the salesmen after interview with:		
		Supt. Book	Supt. Rowe	Mgr. Vance
Holly	1	1	4	8
Brown	2	3	5	2
Smith	3	4	6	9
Metcalf	4	2	9	1
Reed	5	5	1	7
Watson	6	5	8	2
Webb	7	8	2	4
Haines	8	11	7	5
Gray	9	7	9	12
Core	10	8	2	6
Ash	11	10	11	10
Cole	12	12	12	11

Superintendent Book, after a personal interview with each of the salesmen and without knowing what their actual production records were, rated Holly first, Brown third, Smith fourth, and so on as the table indicates. Examination of Superintendent Book's judgments shows that he was not greatly in error in a large number of his estimates. His record was selected, as a matter of fact, for that very reason. The correlation of his estimated ranks with the actual ranks was 0.87. Superintendent Rowe, on the other hand, did not do as well. The correlation in his case was 0.41, while Manager Vance had the poorest record of all thirteen of the executives. His estimates of the abilities of the salesmen were only 6 per cent better than would be due to chance alone. And yet, he uses just such judgments when employing salesmen for his firm!

In Fig. 46 bars are drawn to indicate how much better than chance these executives were able to estimate sales ability in the twelve men. The solid black lines represent each individual judge. The one bar represents the average judge. Another bar represents how high the accuracy might have been if the names had been shuffled and then drawn with the eyes closed, in place of resorting to an interview.

The clear bar is signaled out for special attention because of the importance of the information it conveys. It is the second longest bar. It indicates considerable accuracy. That bar represents the correlation of the rank in production records with the average rank obtained in the personal interviews. Salesman Holly was judged fifth by one executive; fourth by another; first by another, and so on, but, when the estimates of the thirteen executives are averaged, it is found that Holly's average rank is second.

Personal interviews are strewn with pitfalls. One way around these pitfalls is to have several men make separate interviews,

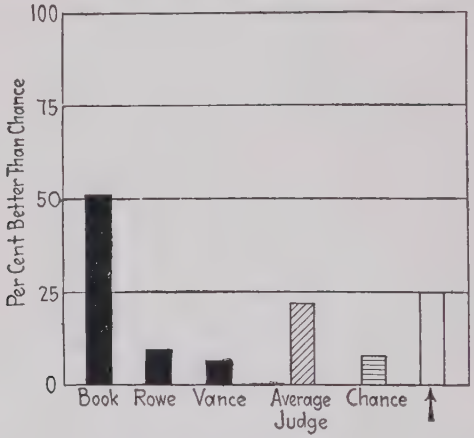


FIG. 46.—How well the interview predicts sales ability is shown by these bars. (Explanation in text.)

reach a decision *independently*, and then have a clerk strike off the average ranks assigned to the men. A conference of "great minds" defeats its own ends in most instances. A conference in such affairs as this usually means that the more aggressive member, or the senior member, or the largest shareholder dominates, and the decision is not a group decision but the judgment of a single person to whom the others have capitulated. The present concern is with the psychology of the personal interview, but this is an important factor in the psychology of the conference that cannot be passed by in the present connection.

Would an engineering department pass scrutiny if it did but slightly better work than could be accounted for by chance? Would iron and steel be bought from a firm that could assure little more agreement from one shipment to the next than could

be accounted for by chance? As the usual employment interview is conducted, one has to be satisfied with a degree of reliability that would not be condoned in any other division.

GENERAL IMPRESSIONS IN AN INTERVIEW

There are several elements that contribute to the unreliability of the personal interview. One of these is that it is first impressions, and largely general impressions only, that are estimated in the interview. In some occupations this may be an essential matter, as in the case of many types of personal service, of salesmanship, claim work, and so on. In the majority of instances, however, the first impression is of little importance—except in getting on the force.

It is obvious that a large amount of this almost complete lack of agreement between the selections of the sales managers is due to the fact that, with all deference to sagacity on the part of the managers, their selections were influenced by the first impression the candidate made as he entered the room and began to talk with them. Presumably the candidate, let us say Clark, entered the presence of each of the twelve sales managers with practically the same bearing, had the same tone of voice, and answered questions in much the same way. Still the managers disagreed greatly in measuring Clark's fitness. Why? Because Clark had a personality or some characteristic to which Mr. Watts reacted favorably, while Mr. Kelly reacted unfavorably to some other characteristic of the same applicant.

First impressions and general impressions do not depend so much upon the person who is giving the impression as upon the person receiving it. Since the general impression of Clark's fitness for the sales job was received by twelve different men, as many different general impressions were obtained. Each one of the managers obtained his general impression of fitness from some little, and usually insignificant, characteristic of the applicant. One might have had a weakness for a certain stride, another a certain type of face, another a fondness for medium-sized men, another for an aggressive talker.

Modern psychology has demonstrated that, in situations such as these, the tendency of the unpsychological observer is to make a judgment or a selection on the basis of just such little things as these, *without being exactly aware of why the selection is made.* Thus one interviewer rejects all candidates who give the gen-

eral impression that reminds him remotely of a rival, while another will rate the same candidate highest because of his resemblance to a prominent relative. It is almost impossible to overcome these unknown tendencies that influence one's general impressions and selections. By a little careful analysis anyone can uncover some of his weaknesses in this respect, but it is hopeless to expect to overcome this pitfall of the personal inter-

INTERVIEW RECORD.

	Better than average.	Average.	Below average.	Remarks
I. Physical qualities: Health, physique, energy, maturity.....				
II. Intelligence: Alertness, scholarship, aptitude, accuracy, common sense.				
III. Leadership: Tact, initiative, cooperation, judgment, ability to supervise and direct.				
IV. Personal qualities: Reliability, self-confidence, enthusiasm, unselfishness, loyalty.				
V. Value to the company or department: Previous training, experience, special interest in company's problems, possibilities for development.				

Comments and recommendations of others .....

.....

.....

.....

Interviewer's notes:

Recommendation: Accepted ..... considered ..... rejected .....

Kind of work suited for .....

.....

Next action promised by interviewer .....

Signed (Interviewer) ..... Date .....

Qualification Record—back.

FIG. 47.—This form does not guide the interview so as to eliminate general impressions entirely.

view by merely trying to hold oneself in check, for one does not fully understand his own foibles.[1]

The way to overcome the inevitable dangers and weaknesses of the general impression is to follow a rating scheme that takes up, point by point, the details that contribute to the general impression. A blank for the interviewer to follow, such as the one given in Fig. 47, eliminates the pitfall of general impression by diverting

[1] The author's article, "Is Your Mind Like an Iceberg?" in *The Forum* for October, 1922, should be consulted for a more detailed explanation of this weakness of human judgments of others.

the attention to details. Thus, in place of the entire judgment of the interviewer being biased largely by the first impression of the applicant, it has been made necessary for the interviewer to consider in detail many points that would be covered over otherwise by his unconscious impressions.

Probably, so long as the applicant is sized up in the presence of the one who draws the final line on the card, that line will be unavoidably modified by the interviewer. Such a procedure as is recommended does not eliminate all of the danger arising from this pitfall of general impression, but it does lessen it greatly. Just what should be analyzed in the interview cannot be finally determined until a study is made of successful employees. Until the content has been scientifically determined in such a way, however, a thorough, armchair analysis of the details should be considered and this will do much to raise the reliability, objectivity, and validity of the personal interview above the level of pure chance. In a later chapter the methods of scientifically determining what are the important items to be considered will be taken up, and also the items that have already been determined for some lines of activity will be presented.

Another important factor that adds to the dangers of the interview is that the statements of the applicant commonly tend to overrate his abilities and experience. With human nature as it is, there is little use in overlooking this matter of exaggeration. However slight this may be in each individual question, after a dozen or more questions have been asked, the cumulative result may be very large. The experience of the industrial specialists with the army draft are illuminating on this point. They found that of all the men who claimed some trade skill only 6 per cent had the skill they claimed. This, also, will be given more thorough discussion in a later chapter.

This pitfall of the interview cannot be eliminated so long as the applicant is asked to tell his trade experiences, salary received in the past, and other incidents in his industrial history. The remedy for this weakness is to resort to tests.

INTANGIBLES IN INTERVIEWS

In many quarters the opinion is rampant that certain important but intangible things can be obtained from a personal interview that can be obtained in no other way. It should be

emphasized that this *is* opinion, and that the facts are directly against it.

Take, for instance, the notion that intelligence can be estimated after a personal conference. Many persons have been consulted who were firmly of the opinion that they could do just this thing. The facts are all against them.

A few weeks ago the newspapers featured the report of a demonstration of this inability to size up "brains" or general ability from appearance. A railroad president and a feeble-minded convict sat upon a platform in front of a large crowd. The members of the audience were unable to tell which was which. Again, this does not imply that the railroad president was feeble-minded; it is another illustration of human inability to estimate intelligence or general ability from an interview, from personal contact, or from personal appearance.

FIG. 48.—Arrange these pictures in the order in which they "look" to you to be intelligent.

You may try this test to convince yourself and your associates on this point. In Fig. 48 there are reproduced the pictures of five young men. Consider these as applicants for a position, selection for which depends upon intelligence or general ability. Select from this group the most intelligent young man. Arrange the five in the order of their intelligence, writing first, on the picture of the one who appears to be the most intelligent; second, on the picture of the one rating next in intelligence, and so on until all the pictures have been numbered. After the pictures are so arranged, consult the correct arrangement at the end of the chapter.

If you have the most intelligent in the upper half of your arrangement you are doing well. Such arrangements as these

have been studied in hundreds of cases, and it has been found that the average is no better than chance. The pictures, in most instances, could be arranged as well face downward!

But perhaps yours is an unusually good arrangement. Does this mean that you have unusual ability in judging intelligence from personal appearances? Hardly. In Fig. 49 there are five other pictures. Arrange these as you did the first five, then compare this arrangement with the correct arrangement given at the close of the chapter. The person is yet to be found who can do 10 per cent better than chance alone on two sets like these. If the first estimations were unusually good, the second set was probably poor. This does not mean that you have suddenly

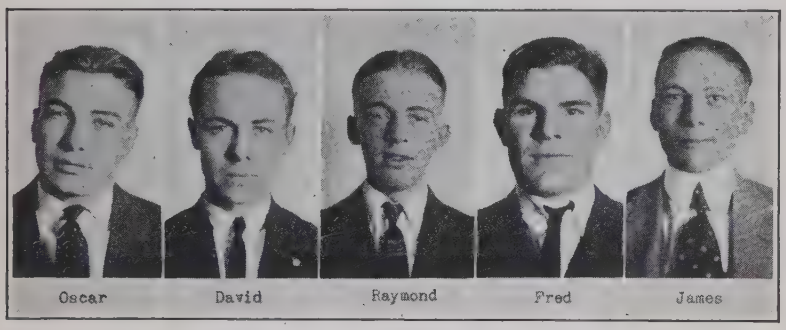


FIG. 49.—Arrange these as was done with the pictures in Fig. 48.

become worse. It means only that the first good arrangement was due to a streak of luck and not to any special ability.

It may be maintained that a photograph is deceptive. True enough. But not any more deceptive than personal appearances. How greatly a change of necktie, or the addition of glasses, or a smile, will change one's "apparent intelligence" is clearly seen in the five photographs given in Fig. 50. Arrange these as has been done with the other two sets. After you have done this, compare immediately with the key at the close of the chapter.

No one has yet been discovered who could consistently do 10 per cent better than chance in estimating intelligence from photographs. According to the records of several professional character readers, they failed as often as the ordinary unpretending person did. It is doubted if there is anyone who can consistently do better than guesswork in estimating intelligence from appearance, or after a few minutes' conversation. What is true

for intelligence probably also holds good for most of the other traits of human character.

Professor Herman Remmers of Purdue University and the author have made a study of the abilities of several hundred

FIG. 50.—Arrange these five men in the order of their intelligence.

persons to estimate general mental ability from photographs, persons from Wyoming and Colorado to Connecticut being studied. It was found that:

1. Individuals attempting to arrange the pictures of ten persons according to intelligence could do about as well with their eyes closed as with them open.

FIG. 51.—Which is the better liked and more popular of the two?

2. That any success better than this is due to luck as was proved by having those who did well on one set of ten arrange another set, whereupon their apparent superior abilities had disappeared.

3. That women are no better at judging relative intelligence from photographs than are men.

4. That older persons have no more ability in this particular than have younger ones.

5. That the more intelligent persons have no better abilities in this than persons with less intelligence.

6. That there was a slight tendency for both men and women to overestimate the intelligence of women from their photographs; this being, however, very slight.

7. That the ability to estimate intelligence in this way appears to be lessened when the pictures are not uniform.

8. That in judging only two pictures, as in judging ten one might as well close his eyes.

9. That a group of two, four, or five judges working together does no better than a single judge arranging the pictures for himself.

FIG. 52.—Some persons are of the opinion that eyes reveal intelligence. Are the upper or lower eyes of the more intelligent person? Which is a man?

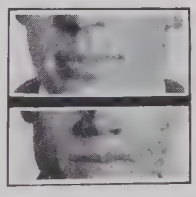


FIG. 53.—Others think that the nose and mouth reveal intelligence. Which of these is the more intelligent?

10. That professional character readers and vocational experts studied did no better than the average of the 376 other persons in arranging these pictures.

Regardless of whether the average person-at-large is a disciple of Blackford, Freud, or any other analyst, he still possesses a large modicum of belief in his own ability in "sizing up" others by appearances. It is hard to dislodge. The school superintendent demands a picture of the candidate for a position in the public schools. No picture; no job. Pictures taken within certain date limits are one of the necessary qualifications for entering the consular service. And so the fable runs, from Federal government to individual, in anticipating an understanding of certain characteristics from personal appearance.

Within fairly recent years it has come about that men have conscientiously attempted to check-up their "hunches" by exper-

iments. There are on record several noteworthy attempts which have been made to check up on this "instinctive realization"—to quote an advertisement—that facial characteristics do betray the inner man. Our pictures may not be representative of the ability to "size up" the flesh and blood. Studies have been made of this very point.

The earliest study was reported by B. R. Simpson. He compared the estimates of intelligence of a group that had been given tests 4 years earlier, in 1907. His subjects were professors and students in Teachers' College, Columbia University. He obtained correlations that ranged from plus 0.97 to plus 0.65. This is much higher than is obtained from photographs. On the whole, the professors tended to have the higher correlations. Another early study was that made by Williams, in California. He asked teachers in four cities in the state to select those pupils in their classes whom they regarded as feebleminded. When the Intelligence Quotients of children so selected were determined, it was found that the range extended from 57 to 117; 100 is average. Of the children selected by the teachers as being feebleminded 26 per cent were in reality normal or superior when checked up by the Binet scale.

C. F. and L. M. Chassell made a somewhat similar study. They obtained a correlation of 0.42 between teachers' estimates of intelligence and the actual intelligence of the pupils in the first three grades, as determined by the combined results on the group tests given. F. Fordyce, working in Nebraska, found a correlation of 0.44 between teachers' estimates of intelligence and actual intelligence as measured on standard scales. There was a tendency for the correlations to be higher in the higher grades. Working in the Saint Paul schools, Varner found that the teachers could estimate the upper and the lower 20 per cent in intelligence with fair accuracy. The teachers were also able to estimate intelligence better than the IQ. E. E. Lindsay, at the University Observational School, Iowa City, had a group of graduate students in education, their professor, and the teacher of the class estimate the intelligence of a group of tenth-grade children. When correlated (R) with the Binet test the coefficients were found to range from 0.38 to 0.52. The lowest correlation was that of their regular teacher. All the visitors rated the intelligence of the pupils with greater accuracy than did the teacher.

The general result of this group of studies would rather discourage any conscientious attempt to estimate general mental fitness from "looks."

Avoid the pitfall of thinking that you, or anyone else, can size up the applicant with much accuracy by a survey of his appearance or after a few minutes of conversation. It is desirable to have confidence in oneself, but do not encourage this entirely unwarranted confidence. Remember that if you can consistently do slightly better than chance you are one in a million.

It would be unwarranted to lay this subject aside with the impression that psychology has nothing to contribute to industry except to point out what is wrong. Nothing could be further removed from the truth. We have gone into this matter in detail, because there is no warrant for psychology rushing in and assuming that it can do something when there is nothing needed.

A plant would not be equipped for manufacturing certain articles until it had been ascertained whether or not there was a need for those articles. At present, psychology is in a similar position.

Neither should it be assumed that these pitfalls are unavoidable. Many of them have been eliminated by modern scientific methods and it is possible for the personal interview to be made a procedure of great reliability and validity. How this is to be accomplished will be unfolded as we progress.

In Fig. 48 the order of intelligence, from most to least, is: Manus, Curtis, Alfred, John, Ralph.

In Fig. 49 this order is: Raymond, James, Fred, Oscar, David.

It may be a surprise to learn that the persons in Fig. 50 are those also shown in Fig. 48.

Victor is the better-liked of the two in Fig. 51.

The lower eyes in Fig. 52 are of the more intelligent person. Both are men.

The upper photograph in Fig. 53 is of the more intelligent individual.

All the photographs are unretouched.

CHAPTER VII

CHARACTER READING

This is an optimists' world; one simply cannot destroy an idea, whether it be workable or not. Character and its attempted diagnosis are illuminating examples of this fact. No one can gainsay the importance or existence of character. It forms the nucleus of most moral systems and, with no exaggeration, it may be looked upon as the hub of the business world. Although the practical and idealistic existence of character is readily admitted, there is much perplexity when an attempt is made to tell what character is, or where it can be located.

These very questions have caused much puzzling throughout the ages and, to the present day, societies are organized to study possible answers to them. Even magazines contain advertisements of courses in character reading. If these questions can be answered definitely and scientifically, a great new future in human relations will have been opened. If, on the other hand, no decisive and positive reply can be given to them, there is a great field of scientific research waiting for the person with the vision and the scientific acumen necessary for solving this riddle of human nature.

THE HUMOR THEORIES

The belief that the riddle of character had been solved was prevalent in Greece in the fifth century, B.C. Without any experimental evidence, of course, it was commonly believed that human temperaments could be described in terms of the four elementary substances. The philosophy of that time regarded all creation as composed of the four elements—air, fire, earth, and water. Everything seemed to go by fours. Since there were four elements in creation, four seasons in the year, why not—just as reasonably—four temperaments by which human character might be described?

There was the *sanguine temperament* which, by the speculative analogies then employed in settling such arguments, was based upon the blood—one of the four humors of the body. Since

the blood typified one of the four seasons, spring, it was reasonable to state that the sanguine temperament, like spring, was warm and moist. Similarly for the other humors and their temperaments. Black bile, which is the analogue of fall, became the determiner of the melancholic temperament which, like fall, is cold and dry. The yellow bile had its relation to warm, dry seasons and as such the choleric temperament became a representative of summer. The remaining humor, the phlegm, of the ancient Greeks was allied with winter, which typified the languid temperament still bearing the name of phlegmatic.

This acrobatic reasoning is apt to be taken as a joke today, but the names of the four temperaments thus derived are still in everyday speech. It is evident that it was no joke when the humor theory of temperaments was in its prime, for this afforded the basis for medical treatments. Yet, in spite of the gross inconclusiveness, these four temperaments are an illustration of the fact that it is hard to keep people from believing what they want to believe even in the absence of experimental or conclusive information.

THE THEORIES OF ASTROLOGY

The four temperaments and their humors that explained the traits of human character gradually suffered decline and, in place of this materialistic conception, there developed a spiritist theory. Character was read, and guidance for the future was given, in the light of the position of the planets at the time of one's birth. If the time of birth showed favorable relations to Jupiter, one was predestined to be of jovial nature, while if Saturn ruled the scene at the critical moment one was doomed to a gloomy nature. This ancient superstition is carried down in our present use of the word saturnine, to describe gloomy events.

Is this supersitition ancient? In point of origin it is centuries old, but it is still a current belief and practice in many quarters. Daily newspapers contain the horoscopes of persons determined by the position of the planets, presumably, at the time of birth.

There is no reason for believing that the planets have anything to do with character. This belief came into great vogue because everything for a time in the world's history was attributed to the planets, just as the Greeks had attributed everything to the mystical four humors.

In this day and age everything is not organized by fours or in imaginary step with the planets, but there exist foibles and fads by which the puzzles of the ages are presumed to be solved.

send
birth date
Are You Reaching for the Truth?
I will tell you
FREE
Under which Zodiac Sign were you born? What are your opportunities in life; your future prospects, happiness in marriage, friends, enemies, success in all undertakings and many other vital questions as indicated by ASTROLOGY, the most ancient and interesting science of history?
Were you born under a lucky star? I will tell you, free, the most interesting astrological interpretation of the Zodiac Sign you were born under.
Simply send me the exact date of your birth in your own handwriting. To cover cost of this notice and postage, inclose twelve cents in any form and your exact name and address. Your astrological interpretation will be written in plain language and sent to you securely sealed and postpaid. A great surprise awaits you!
Do not fail to send birthdate and to inclose 12c. Print name and address to avoid delay in mailing.
Write now—TODAY—to the
ASTA STUDIO, 309 Fifth Ave., Dept. PH, New York

FIG. 54.—This recent advertisement shows that astrology still persists in spite of being no more than superstition.

THE THEORY OF PHRENOLOGY

Of course explanations of character based upon the planets went by the boards, but the succeeding generations were bent on solving the riddle of character as had been the generations before them. Men were entering upon the infancy of science. They were beginning to study Man, himself, and not the planets, to find out the secrets of his nature. People began to think that perhaps the brain might have something to do with mental life and character traits. Scientific observations were coming to be more and more respected and used as the basis for opinions and conjectures.

When the brain was injured physicians had remarked noticeable changes in persons. In other cases, where the brain was exposed to view by accident or operation, it had been noticed how a finger or a foot or an entire limb would move and twitch when different regions of the brain were irritated. Here seemed to be some experimental basis for the study of character but

obviously it would be time consuming. Accidents could not be produced at will to see what particular regions of the head seemed to be correlated with character qualities. For a time it appeared that it would be necessary to have centuries of accidents, accumulated and carefully recorded, before there would be adequate foundations for a science of character.

The hope of being able to understand and to read character seemed for a while to be doomed to postponement for many years to come, especially since the scientific attitude demanded that no further credence be given to the fanciful explanations of character as a result of the effects of humors or stars. But hopes cannot be downed, especially such a hope as this.

A Viennese graduate in medicine reasoned as follows to avoid the postponement of character analysis: If it is the brain matter that determines character traits, why is it not reasonable to expect that the head itself can give us some insight into these traits? So he proceeded to observe the character traits of those with whom he came into contact. Whenever he ran across a man with a hasty temper, he would look for characteristic features of the head of the hot-tempered man that did not seem to be found in even-tempered persons. Soon this physician had a well-classified assortment of head or skull peculiarities and the character traits that he had observed along with these bodily features.

This man was Franz Joseph Gall; his method of studying character is known as phrenology or crainoscopy. When he was forty, in 1798, he began giving public lectures on his findings. These lectures were continued only 4 years when the government forbade him to preach his doctrines. They did not order him to stop because his conclusions were not well-founded. The government ordered him to stop because phrenology was dangerous to the current religion! One natural result of this action was that public interest was immediately aroused in phrenology. It seems to have been the irony of fate that what appears to have been the first scientific method of telling character was suppressed. But the government orders did not suppress public interest.

What does one hear of phrenology today? It is a century and a quarter old, older than most of our machines and medical knowledge. If phrenology were well-founded, would not one

expect it to be developed to almost scientific perfection at this time?

Phrenology *is* current to the present day although it lacks the popular public interest it had when it was suppressed. I am told on good authority that there is at least one school in the United States that is devoted exclusively to teaching the "art and science of crainoscopy." One cannot be long in the foreign quarters of our cities without finding a darkly curtained room devoted to phrenology, with large charts of the human head neatly divided into regions determining character.

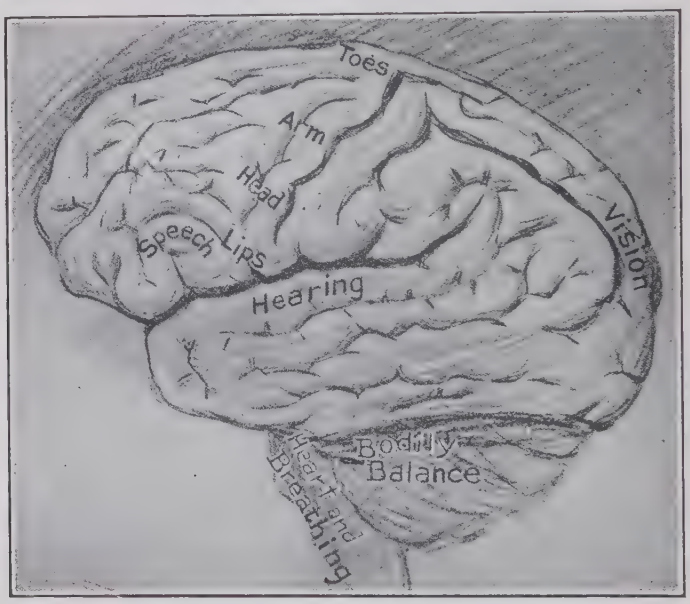


FIG. 55.—The *actual* functions centered in different regions of the brain are shown by this drawing. The eminence to the left is immediately behind the bones of the forehead.

Not only is this true in the foreign quarters; a successful minister of one of the leading denominations in Saint Louis has a phrenologist read the character of his boys when they enter the sixth grade. The future educational careers of the boys depend upon the analysis and advice of this phrenologist. The phrenologist has a small booklet of a dozen or more pages in which are listed hundreds of character traits. On the cover of this booklet he writes the name of the boy and then checks with pen and ink the character traits that the boy has. Traits that are

especially prominent are underscored. On the last page is written the vocation or occupation for which the bumps on the boy's head show him to be best fitted.

If phrenology really can do all this reliably and accurately, it is a pity that all of us do not have our little booklet of strengths

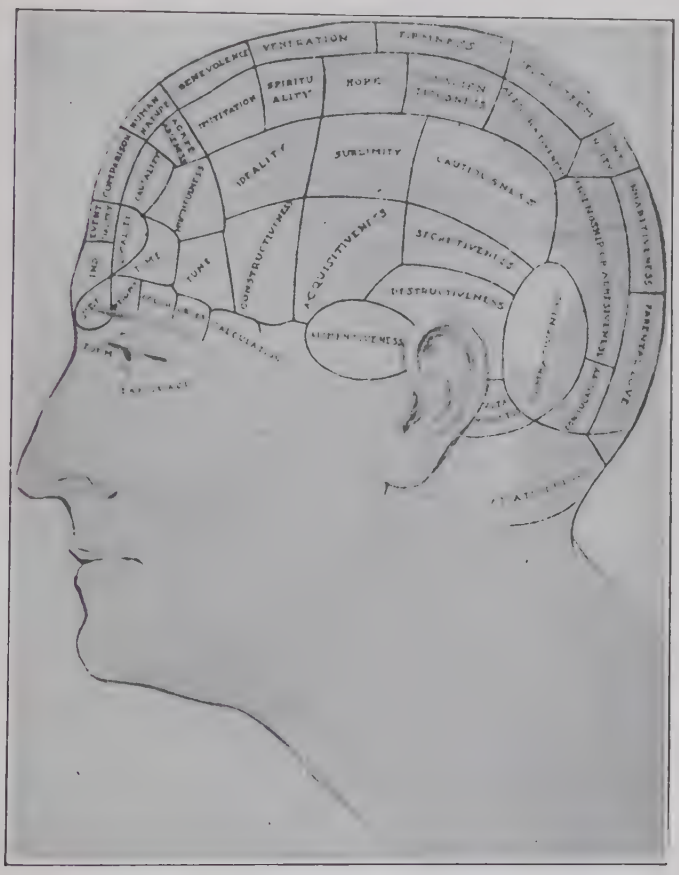


FIG. 56.—A *phrenological chart* of the alleged functions of different brain areas. Compare with Fig. 55.

and weaknesses, or that the prospective employer does not have the bumps on an applicant's head recorded in a similar booklet. Phrenology started off amid great enthusiasm. Is the enthusiasm gone or is there nothing to phrenology after all?

Gall first noticed that some persons he knew who had powerful memories also had prominent eyes. He inferred from this that

all persons with prominent eyes had remarkable memories. Following this conclusion he noticed the worshipers at church, and he searched among the most devout attendants for some distinctive characteristic. Finally he succeeded, so he thought, in finding the part of the head in which *veneration* was located. From the church he went to the prisons and hunted for a bump, or organ, for *theft*, and another for *murder*. He continued in this manner until he had located to his satisfaction the regions of the skull—or organs as he called them—to indicate twenty-four traits such as those we have just mentioned.

There can be no doubt that Gall had a scientific interest in the work he was doing. He obtained the skulls of great personages and studied these to ascertain any features that might give evidence of their character traits. Among the living there were many with marked character peculiarities who were induced to shave their heads and have a plaster cast made that Gall might study the contour of their skulls.

Later he extended his studies to animals and was puzzled for a long time over a prominent part of the cranium that is a characteristic of both women and monkeys. He tells how:

> . . . in a favorable disposition of mind, during the delivery of one of my lectures, I was struck with the extreme love that these animals have for their offspring. Impatient of comparing immediately the crania of male animals in my collection with those of females, I requested my class to leave me, and I found, in truth, that the same difference exists between the male and female of all animals, as existed between man and woman.

Thus did he locate the region of the skull in which "love of offspring" is located!

THE RISE OF PHYSIOGNOMY

Modern phrenology is not limited by the twenty-four "organs" located by Gall. Many more have been added and many of the teachings are in conflict with each other. What scientific basis has there been for the addition of other "organs" to the original list compiled by Gall?

Some, with ludicrous but pathetic simplicity, analyzed persons with the appearance suggestive of a sheep as being timid, while persons with sharp, pointed features resembling a fox were considered shrewd. Others were analyzed as being wise

and non-communicative because their eyes were large, similar to those of an owl. Character came to be read in every feature of the body as well as in the cranium. This is the advent of *physiognomy*. Physiognomy has been a riot of unrestrained analogies without the least pretense at experimental or scientific basis.

What most persons are content to take merely as a figure of speech in speaking of one as a pig, or a sly fox, or an ass, the physiognomists accept eagerly as giving insight into the manifestations of character. A book published within the last few months justified its catalogue of the earmarks of human character by drawing upon the animal kingdom in general. The only advance that has been made is that modern engravers and printers can make a neater appearing reproduction. The fundamental and fatal logical errors, that any one with half an eye can see, persist. In this 1924 book—which is widely circulated and followed—there are pages devoted to pictures of snakes, lizards, and toads and the following page is devoted to human beings with snake-eyes, lizard foreheads, and such.

This boy should be in:
Civil Engineering Forestry
Transportation Construction
Salesmanship Agriculture
and similar lines, depending upon other traits by which the vocational counsellor decides by the process of elimination.
Fair hair, blue eyes, fair skin;
Forhead prominent at brow, wide at lower section;
Head high, wide ears and round;
Large, prominent nose, high in bridge;
Broad square shoulders, narrow hips;
Large hands with square finger tips.
This lad is eye-minded. Doesn't like study. Hates detail and confinement. Demands physical activity. Belongs in the open.
To require him to become a lawyer, or a desk man in any line, condemns him not only to failure but to impaired health and life long regret and unhappiness.
Get these books on trial—
Analyze YOUR Child

FIG. 57.—This was used in advertising a book on "character reading." Its teachings about blonds, brunettes, and others have been disproven.

ARE THESE "SYSTEMS" VALID?

Phrenology proper is in disrepute among scientists in general and among psychologists and physiologists in particular. This

is for two reasons. Phrenology involves some assumptions that a scientist would scarcely grant, and in addition definite knowledge of the functions of the different regions of the brain directly contradicts all of the teachings of Gall. The phrenologists were impatient at the delay in accumulating knowledge of the brain by waiting for accidents to expose the brain regions to experimentation. They tried to take a short cut to knowledge. Shortcuts are dangerous, and they turned out to be especially so in this case.

When accidents had made it possible to know definitely the functions controlled by certain brain regions, it was found that the region near the middle of the top of the head was not given over to veneration, as the phrenologists had taught, but to the control of the movements of the legs and feet. Similar erroneous

> WANTED: A first class man with experience for permanent position on staff of Vice President to shape and direct the advertising policy of a trunk line railroad. To save time and trouble to both applicant and employer, kindly send in photographs—1 full length, 1 exact profile view (bust) and 1 front view (bust) full face, holding hands in front of body, one palm outward and the other hand palm inward. Call for recommendation and personal interview will come later. "Vice President," Box 16, care *Printers' Ink.*

FIG. 58.—This advertisement appeared in *Printers' Ink.*

conclusions that the phrenologists had reached by their short cuts to truth may be ascertained by a comparison of the chart of the regions of the head drawn by a phrenologist of the present day with what scientific neurologists and physiologists have demonstrated to be the actual functions of the brain regions indicated.

Phrenology as it was taught and practiced was erroneous from start to finish; today, it only persists in out of the way places. Physiognomy, on the other hand, is in current practice. When it was demonstrated that the spot supposed to control "veneration" according to phrenology really controlled the wiggling of the great toe, those in quest of short cuts to the analysis of character began to study parts of the body other than the head. Using the same short-cut methods of few observations, these people have settled—to their satisfaction—the character traits of blonds and brunettes. With what accuracy they have settled this particular issue will be shown later on by actual

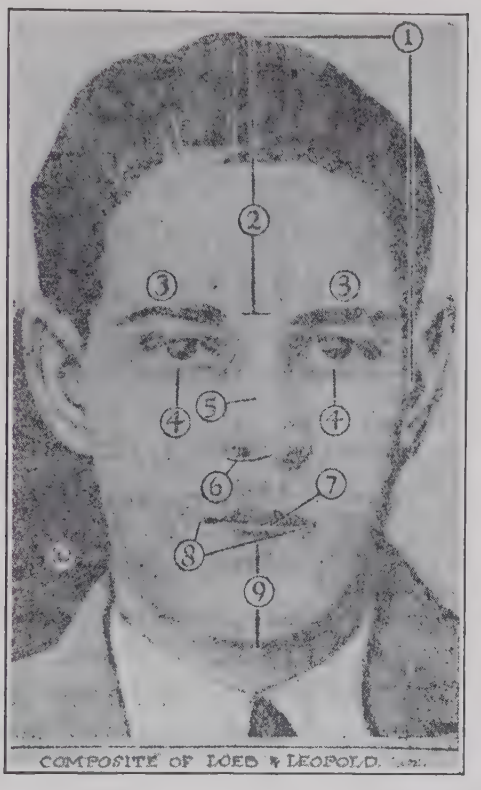


FIG. 59.—This is an illustration of physiognomy. Phrenologists related these traits to the cranium proper. Compare with Fig. 56.

This is a composite photograph of Nathan Leopold, Jr., and Richard Loeb, slayers of kidnapped Robert Franks in Chicago. The alleged indications are:

No. 1. The depth of brain is unusual and shows brain capacity above average.

No. 2. Length and slope of forehead very similar, so that both have same reactions and reflexes.

No. 3. Heavy eyebrows are marked characteristics of amorous and jealous natures.

No. 4. Slightly bulging eyes indicate uncanny memories.

No. 5. Executive ability is emphasized by outlines of slightly humped noses.

No. 6. Distance of noses from base to tip explains in part propensity to delve into many things.

No. 7. Mouth line straight, with slight upcurve at tips, indicate unwillingness to permit any one to cross them.

No. 8. Width of mouth small in relation to head indicating petty character.

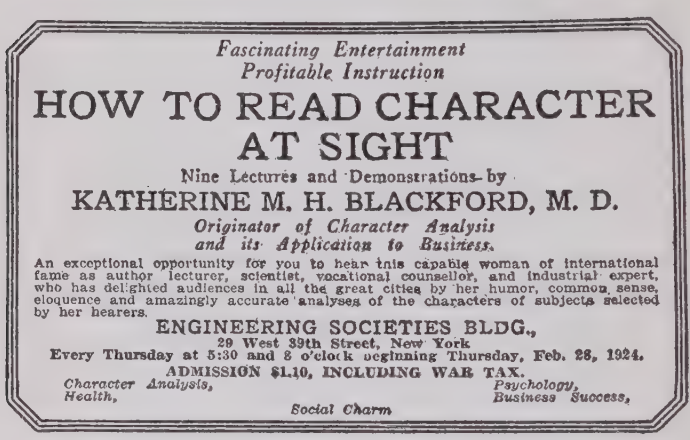
No. 9. Depth of chin almost identical showing same feelings in each.

No. 10. Sweep and curve of jaw are essentially feminine.

experiments made of the alleged differences incident to dark or light skin color.

The general build of the body is considered by the physiognomists as significant. The person who is broad at the shoulders and narrow near the ground, who resembles an equilateral triangle standing on its narrowest point, is an unstable person, while those built more along the lines of a square are steady and stable.

Serious scientific studies have been made of many of the systems that are in vogue at present. These have disclosed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Social Charm

FIG. 60.—This system teaches about blonds and brunettes as mentioned on page 127.

relations which discredit entirely the systems, but which point the way to the development of a method of understanding character. Modern physiognomy may be dismissed completely. It has not been scientifically developed; the teachings of one "authoritative system" are opposed to those of another "final and scientific system." This disagreement indicates that there has been no collusion, and also that the finding of one's character according to one system would be contradicted by another system. A final reason for modern science not accepting physiognomy is that no possible reason can be conceived for believing that the shape of one's fingers can determine mental characteristics.

Studies of Blonds and Brunettes

A belief in mental differences between blonds and brunettes is fairly widespread, and some authors have written an authorative "last word" on this difference. One such states:

> . . . in brief, always and everywhere, the normal blond has positive, dynamic, driving, aggressive, domineering, impatient, active, quick, hopeful, speculative, changeable, and variety-loving characteristics; while the normal brunette has negative, static, conservative, imitative, submissive, cautious, painstaking, patient, plodding, slow, deliberate, serious, thoughtful, specializing characteristics.

This same writer declares:

> . . . color has its commercial application. The active, restless aggressive, variety-loving blond is found in large proportion among speculators, promoters, organizers, advertising men, traveling salesmen; while the more stable and constant brunette predominates among the plodders, the planners, the scientists, the administrators, and the conservators.

It is not difficult to test these particular teachings of this system of character analysis. This work has been done by H. G. Kenagy who studied the super-salesmen of about forty different firms. Salesmen should exhibit blond characteristics, according to our writer. The better the salesman, the more blond he should be, for this system states:

> . . . the less the pigmentation in any individual, the more marked will be the characteristics of the blond in his physical, mental, and psychical nature; the greater the degree of pigmentation, the more marked the characteristics of the brunette.

Mr. Kenagy had the sales executives rate the four best producing salesmen they knew well. A list of blond and brunette traits, twenty-six in all, were studied. These executives rated each salesman as to whether or not he was positive, conservative, changeable, etc. The following data show how large a per cent of the 152 salesmen, each among the highest producers for his firm, had the traits they were supposed to have by this character analysis system:

Characteristic	Per cent possessing it
Positive	92
Dynamic	65
Negative	5
Static	13
Conservative	43
Driving	63
Aggressive	87
Domineering	26
Imitative	39
Impatient	40
Submissive	15
Active	93
Quick	68
Cautious	46
Painstaking	68
Hopeful	88
Patient	53
Plodding	27
Slow	12
Speculative	38
Changeable	35
Deliberate	45
Serious	70
Variety-loving	47
Thoughtful	78
Specializing	63

A given trait is probably not a characteristic of the group unless at least half of the members possess it. This is a generous allowance. Thus the consistent characteristics of the high producing salesmen are:

Positive.
Dynamic.
Driving.
Aggressive.
Active.
Quick.
Painstaking.
Hopeful.
Patient.
Serious.
Specializing.
Thoughtful.

How many of these traits are characteristic, according to this character analysis system, of blonds? Scarcely more than half; seven out of the twelve to be exact. Thus we find that these super-salesmen do not have blond characteristics in a very large proportion.

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FIG. 61.—A course of *free* lectures alleged to teach character reading and given by one who is a stranger to scientific psychologists.

A slight discrepancy like this can be overlooked, however, if the salesmen are really blonds, for what easier test could be given to prospective sales representatives than to ascertain the color of their skin. Are these highest producing salesmen in nearly forty firms blonds, or predominately blonds? No! Eighty-two were brunettes, while seventy were blonds. Perhaps the executives could not tell a blond from a brunette; or possibly the alleged difference is unfounded. On this latter point, Mr. Kenagy discovered that there was no significant difference between blonds and brunettes in their possession of alleged blond and brunette traits, as the following data show:

Alleged blond and brunette traits	Per cent possessing traits	
	Blonds	Brunettes
Blond:		
Positive	95	90
Dynamic	68	64
Driving	64	66
Aggressive	87	88
Domineering	29	24
Impatient	40	41
Active	94	91
Quick	68	67
Hopeful	91	85
Speculative	39	37
Changeable	35	33
Variety-loving	48	47
Brunette:		
Negative	3	6
Static	13	13
Conservative	35	50
Imitative	39	40
Submissive	14	17
Cautious	43	49
Painstaking	74	63
Patient	57	50
Plodding	26	30
Slow	6	17
Deliberate	43	47
Serious	70	70
Thoughtful	77	80
Specializing	68	59

In only ten of these traits—positive, domineering, hopeful, painstaking, patient, specializing, conservative, cautious, slow, and deliberate—is there a difference of 5 per cent or more between the blonds and brunettes; in only two—conservative and slow—is the difference greater than 10 per cent. Mr. Kenagy concluded:

> . . . if we had a much larger number of cases, say a thousand salesmen, the chances are that the differences would be even less noticeable. In only three cases do the blonds exceed the brunettes by as much as 5 per cent in the possession of blond traits. In three cases the brunettes actually exceed the blonds. Again, while the brunettes exceed the blonds 5 per cent or more only three times in the possession of brunette traits, the blonds actually exceed the brunettes by 7 per cent or more in three such traits—painstaking, patient and specializing. The evidence of these figures is unmistakable. It is obvious that these so-called blond and brunette traits do not differentiate between human beings who are commonly classified as blonds and brunettes. Any system of selection or character analysis based on these traits is therefore impractical and unsound.

Professor Donald G. Patterson, of the University of Minnesota, has reported a similar study in which his data led to the same conclusions.

Another, and the most recent, study of the validity of character analysis systems has been published by Cleeton & Knight.[1]

They studied the following character traits:

Sound judgment.	Ability to make friends.
Intellectual capacity.	Leadership.
Frankness.	Originality.
Will power.	Impulsiveness.

In testing the teachings regarding physical traits indicating *will power*, thirty-six different physical measurements were made on each of thirty subjects with exact anthropometric instruments. The following two tables show the wide range of physical traits measured to check up on the teachings regarding two of the character traits:

OUTLINE OF FACTORS USED IN THE STUDY OF TRAIT JUDGMENT

Hypotheses: That judgment is indicated by the following physical factors.

A. Large cranial development.

Measured by:

1. Circumference—anterior inferior to posterior central.
2. Circumference plus height of head from meatus vertical.

[1] *Journal of Applied Psychology*, vol. VIII, pp. 215–231, 1924.

3. Length of head—glabella to occipital protuberance plus height plus maximum breadth.

B. High development of anterior lateral region.
4. Width of head at temples.

C. High development of upper part of forehead.
5. Breadth—frontal eminences.
6. Length—from meatus to anterior superior.
7. Length—from meatus to anterior superior plus breadth of frontal eminences.

D. High development of the entire anterior region.
8. Average breadth of forehead.
9. Average length from meatus to anterior regions.
10. Average breadth of forehead plus average length from meatus to anterior regions.
11. Average breadth of forehead plus length, meatus to anterior regions, plus height of head.
12. Ratio—anterior length of head; posterior length of head—measured from meatus.
13. Ratio—anterior inferior length: posterior central length—measured from meatus.
14. Ratio—anterior superior length: posterior central length—measured from meatus.

E. Wide head.
15. Maximum breadth of head.
16. Cephalic index.
17. Breadth divided by height index.
18. Breadth divided by (height plus length) index.

F. Great breadth between eyes.
19. Eye-to-eye center.

G. Arched nose.
20. Average length from meatus to root and tip of nose subtracted from length, meatus to bridge of nose.

H. Small eyes.
21. Eye opening vertical (inverse).
22. Breadth of eyes horizontal (inverse).
23. Vertical opening of eyes plus breadth (inverse).

I. Broad blunt facial features.
24. Average breadth of nose.
25. Breadth of mouth.
26. Breadth of chin.
27. Breadth of nose plus breadth of mouth plus breadth of chin.

J. Vertical forehead profile.
28. Length, meatus to anterior superior, less length, meatus to anterior inferior.

OUTLINE OF FACTORS USED IN THE STUDY OF TRAIT INTELLIGENCE

Hypotheses: That intelligence is indicated by the following physical factors.

A. Large cranial development.
Measured by:
1. Circumference—anterior inferior to posterior central.

2. Circumference plus height of head from meatus vertical.
3. Length of head—glabella to occipital protuberance plus height plus maximum breadth.

B. Large ratio head development to body.
4. Circumference—anterior inferior to posterior central divided by weight.
5. Circumference plus height of head divided by weight.
6. Height plus breadth plus length of head divided by weight.

C. Wide forehead.
7. Average width of forehead.

D. Prominent anterior superior region.
8. Breadth frontal eminences.
9. Length from meatus to anterior superior.
10. Length from meatus to anterior superior plus breadth of frontal eminences.

E. Prominent anterior lateral region.
11. Breadth of head at temples.

F. High head.
12. Height—meatus to top of head.
13. Height divided by length index.
14. Height divided by breadth index.
15. Height divided by (breadth plus length) index.

G. Great length from ears forward.
16. Meatus to anterior inferior.
17. Ratio—average anterior length: average posterior length of head.
18. Ratio—anterior inferior length: posterior central length—measured from meatus.

H. Great breadth between eyes.
19. Eye-to-eye center.

I. Small eyes.
20. Eye opening verticle (inverse).
21. Breadth of eyes horizontal (inverse).
22. Vertical opening of eyes plus breadth (inverse).

J. Large facial features.
23. Average breadth of nose.
24. Breadth of mouth.
25. Breadth of chin.
26. Length plus height of nose.
27. Breadth of nose plus breadth of mouth plus breadth of chin.

K. Long nose.
28. Length of nose.

L. Straight nose.
29. Average length from meatus to root and tip of nose subtracted from length, meatus to bridge of nose.

That these physical traits are lacking in objectivity—when they are supposed to indicate the same qualities—is shown by the following table:

INTERCORRELATIONS—PHYSICAL FACTORS—TRAIT JUDGMENT. SPEARMAN RANK METHOD—TWENTY-EIGHT CASES

Factor	A-2	A-3	C-7	D-12	E-15	E-18	G-20	H-23	I-27	J-28
A-2....	.....	0.86	0.37	0.48	0.32	−0.07	−0.50	−0.64	−0.65	−0.20
A-3....	0.86	.....	0.40	0.42	0.57	0.12	−0.29	−0.70	0.42	0.06
C-7....	0.37	0.40	.....	0.32	0.45	0.57	−0.09	−0.66	−0.19	0.02
D-12...	0.48	0.42	0.32	.....	0.71	0.53	0.08	−0.40	0.35	−0.20
E-15...	0.32	0.57	0.45	0.71	.....	0.67	0.08	−0.53	0.50	−0.48
E-18...	−0.07	0.12	0.57	0.53	0.67	.....	0.15	−0.44	0.06	−0.39
G-20...	−0.50	−0.29	−0.09	0.08	0.08	0.15	.....	0.26	0.11	0.14
H-23...	−0.64	−0.70	−0.66	−0.40	−0.53	−0.44	−0.26	.....	0.02	−0.06
I-27....	−0.65	0.42	−0.19	0.35	0.50	0.06	−0.11	0.02	.....	−0.56
J-28....	−0.20	0.06	0.02	−0.20	−0.48	−0.39	0.14	−0.06	−0.56	
Mean..	−0.003	0.215	0.312	0.255	0.255	0.122	−0.031	−0.350	−0.017	−0.185

Almost half of these correlations are negative and the highest mean correlation is only about 8 per cent better than chance!

But it may be possible that some one of the physical measures correlate with the character trait of judgment. That none of the twenty-eight physical measurements do indicate judgment is shown by the following correlations:

CORRELATION EXISTING BETWEEN RATINGS OF CLOSE ASSOCIATES AND PHYSICAL FACTORS

Pearson product-moment method of trait judgment

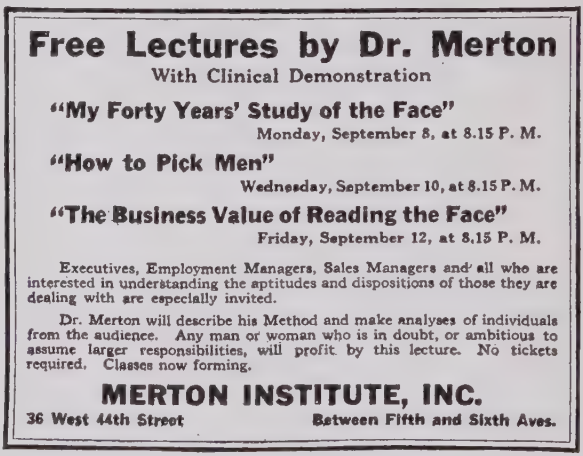
Physical factor	Standard measures (twenty-eight cases)	P.E.
A-1	−0.04	0.127
A-2	−0.10	0.126
A-3	−0.12	0.125
B-4	0.21	0.121
C-5	−0.06	0.127
C-6	−0.04	0.127
C-7	0.08	0.126
D-8	....	0.127
D-9	0.06	0.127
D-10	0.05	0.127
D-11	−0.04	0.127
D-12	0.29	0.116
D-13	0.38	0.108
D-14	0.31	0.115
E-15	0.09	0.126
E-16	−0.09	0.126
E-17	0.00	0.127
E-18	−0.01	0.127
F-19	−0.14	0.125
G-20	0.03	0.127
H-21	0.06	0.127
H-22	−0.07	0.127
H-23	−0.04	0.127
I-24	−0.27	0.118
I-25	−0.34	0.112
I-26	−0.07	0.127
I-27	−0.12	0.125
J-28	−0.20	0.122
Average	−0.005	

The average correlation is zero. There were 201 such correlations studied. The average correlation of the physical factors for each character quality was as follows:

AVERAGE CORRELATIONS—PHYSICAL FACTORS AND TRAITS INDICATED

Trait	Correlations
Judgment	−0.005
Intelligence	0.027
Frankness	0 055
Friendliness	−0.11
Will power	−0.074
Leadership	−0.041
Originality	0.095
Impulsiveness	0.100

It is apparent that these alleged character signs agree neither with themselves nor with other more acceptable measurements of character.



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With Clinical Demonstration

"My Forty Years' Study of the Face"

Monday, September 8, at 8.15 P. M.

"How to Pick Men"

Wednesday, September 10, at 8.15 P. M.

"The Business Value of Reading the Face"

Friday, September 12, at 8.15 P. M.

Executives, Employment Managers, Sales Managers and all who are interested in understanding the aptitudes and dispositions of those they are dealing with are especially invited.

Dr. Merton will describe his Method and make analyses of individuals from the audience. Any man or woman who is in doubt, or ambitious to assume larger responsibilities, will profit by this lecture. No tickets required. Classes now forming.

MERTON INSTITUTE, INC.

36 West 44th Street Between Fifth and Sixth Aves.

FIG. 62.—An advertisement of a "character reader" who calls himself a doctor but who, so far as has been discovered, has no degree giving him the right to the title.

Dean Herman Schneider, of the College of Engineering of the University of Cincinnati, has said regarding one system that is widely advertised:

It seems to be a development of the old idea of phrenology. It is claimed in this system that physical characteristics indicate certain abilities. For example, a directive, money-making executive will have a certain shaped head and hand. A number of money-making executives were picked at random and their physical characteristics charted. We have not found that they conform at all to any law.

Also, we found men that had physical characteristics that ought to have made them executives, but they were anything but executives. A number of tests of this kind gave negative results. We were forced to the conclusion that this system was not reliable.

But may there not be some physical traits that betray character? There have been some scientific studies made to find traits that would. Dr. Sante Naccarati, of the Post Graduate Medical School, New York City has studied hundreds of cases with results that are not uniform. Between intelligence and height, for instance, he has obtained correlations, as follows, with different groups of subjects:

0.02
0.11
0.04
0.14

Between weight and intelligence, these correlations have been found with different groups of subjects:

0.11
−0.02
0.18

When the ratio of height to weight is correlated with actual intelligence, different groups yield the following correlations:

0.44
0.15
0 13

Dr. Naccarati was unable to find a physical trait that could be reliably and objectively measured, and that would significantly and consistently predict general mental ability.

Dr. Karl Pearson, the illustrious English biometrician, studied 5,000 subjects in the effort to discover any relation between certain physical characteristics and abilities. He found the following correlations:

	Adult men	Boys	Girls
Cephalic index	−0.06	−0.04	0.07
Head length	0.11	0.14	0.08
Head breadth	0.09	0.11	0.11
Auricular height	....	0.07	0.05

There is a *very slight* relationship, but one that is impracticable for all practical purposes. For instance, it would require a difference of about 4 inches in head measurements to account for the observed differences in abilities.[1] His data led Dr. Pearson to say:

> . . . the onus of proof that other measurements and more suitable psychical observations would lead to more definite results may now, I think, be left to those who *a priori* regard such an association as probable. Personally, the results of the present inquiry have convinced me that there is little relationship between the external physical and the psychical characters in man. Future papers from my laboratory . . . will serve to confirm this view.

On Friday Professor Pearson's papers were carefully reread and his intricate tables of data again studied. Following which, this short report was written. What do you suppose was discovered in the newspaper columns this morning? An advertisement of a course of lectures to teach the ever gullible readers how to read character at sight—and they will be told about blonds and brunettes as Mr. Kenagy and Professor Patterson have found they are not. And not only is this course of lectures, that are fraudulent in teachings, to be given, but given in a building devoted to the most exact of the applied sciences—the Engineering Societies Building in New York City. Shades of the middle ages!

It is well to give everybody a free hearing; the expression of opinion should be free and unrestricted. But these courses do not qualify, when—without exaggeration—hundreds of thousands of dollars are taken in each year by their promoters, and government agents are sent to secure income tax returns from some of them. They no longer come in for a *free* expression of opinion.

Their advertising is untruthful. They do not and cannot read character, and they cannot teach how to do it. Their advertising should be suppressed. They should be denied halls and the use of the mails. They should retire to the wilderness and associate with the exponents of other exploded theories.

[1] *Biometrika*, vol. V, pp. 105–146, 1906–1907

CHAPTER VIII

THE APPLICANT'S INDUSTRIAL HISTORY

It is important that reliable records be readily available of the applicant's industrial past at two crucial points in the employer-employee relationship. The first crucial point is when he is taken on the payroll. Except in the case of the most inexperienced novice, more consideration is probably given to the past industrial record of the applicant in determining his qualifications than to any other single factor. In the industrial systems of some foreign countries the past industrial record is easily obtained from a work-record booklet that every applicant must present. This contains not only his industrial record but his educational and military records as well.

After the applicant has given evidence of a favorable history in certain industrial pursuits, and is taken into the employ of the firm, his *firm past* is not neglected. When promotions are to be made from the ranks to positions of increasing responsibility, the records of the employees, in work that would have prepared them for the promotion, are considered.

GETTING THE APPLICANT TO TELL HIS INDUSTRIAL RECORD

In less important positions the only check that is made, oftentimes, of the applicant's past industrial record is to ask him for whom he has worked, how long he worked at each place, what his salary was, and the nature of the work he did. It is safe to infer that in the majority of instances the applicant's own statements are considered adequate when checked by a few pointed questions asked by someone in the plant who understands the work in question. This is to guard against bluffing.

An employment manager recently stated that he discounts 10 per cent of every statement that is made by an applicant with reference to his previous work. Others take a somewhat similar attitude, realizing that a long bow is being drawn and that some allowance must be made for intentional—or unintentional—exaggeration.

Those engaged in the personnel work in the army drafts soon came to realize the magnitude of exaggeration of trade abilities.

In interviewing, they found that only 6 per cent of those who claimed skill in a given trade really were skilled enough to stand up on the job as experts, while 30 per cent were totally inexperienced! So long as the men's word alone was taken, a situation resulted in which many apprentices, some journeymen, and even novices posing as experts were placed beside experts. Of these, 6 per cent lived up to expectations; 94 per cent failed to reach the level that the report of their past industrial experiences had indicated they might reach.

In the report for the year ending June 30, 1923, the United States Civil Service Commission records 229,640 persons examined. Out of this number, 835 were barred from holding official positions because of attempts to deceive the commission. These were the ones who were caught. Some estimate of those who were not caught can be made from the report of the 8,446 eligibles in New York City and vicinity. All of these swore that they had no criminal records, but finger-print experts found that 181 had criminal records. This is a ratio of one out of forty-seven. Assuming that this ratio holds for all examinees, there were 4,886 with criminal records, of whom over 4,000 were not detected.

CAN ONE ESTIMATE HIS ABILITIES?

Dr. Harry L. Hollingworth of Columbia University found the following errors in a group of twenty-five who seriously tried to rank themselves in the traits indicated. They had previously been ranked by twenty-four who knew them intimately. The figures in the tabulation represent the average displacements of these self-estimates from the position assigned by the combined judgments of the twenty-four associates.

	Steps
Neatness	5.8
Intelligence	6.0
Humor	7.3
Conceit	5.7
Beauty	6.0
Vulgarity	6.1
Snobbishness	5.1
Refinement	7.2
Sociability	5.4
Average	6.1

Dr. Hollingworth comments upon these findings as follows:

If we bear in mind that purely chance arrangements of such a series, from time to time, would give each individual the same average posi-

tion in the series, and that the average deviation of all the separate positions from this average would be a little over 6 steps, it is at once clear that these individual self-estimates are nearly as inaccurate as they possibly could be under the circumstances. The average displacement of the self-estimates from the positions assigned by the acquaintances in 6.1 steps, approximately what it would have been had the names been shuffled instead of seriously and honestly arranged. And it is quite certain that the individual estimates in this investigation were rendered quite as seriously and honestly as they would have been in the formal application blank. The inference seems to be that the Employment Bureau might as well have tossed up a coin, heads meaning "concentrate," tails meaning "skip around," for example, as to ask the applicant to estimate his or her degree of possession of the traits in question.

Yet, it is in just such qualities as these that applicants are asked to characterize themselves in many application forms. These may be important things to know about candidates for certain positions, but the sad facts are that one can never hope in the face of reality to find out with more than chance accuracy from the candidate himself. "Know yourself" may be a splendid aim, but unfortunately the indications are that such knowledge is impossible to attain.

Do We Think Too Well of Ourselves?—It is interesting to notice that in these self-estimates, that would not appear to be selfishly motivated, the common tendency is to place oneself higher in the scale than one is placed by others. This is shown by the following data in which the records of fifty persons have been averaged; a plus sign indicating that the person estimating his own abilities has placed himself that many steps above the position given by him by others. A minus sign, on the other hand, shows a tendency to underestimate oneself by as many steps.

	Steps
Refinement	+6.3
Humor	+5.2
Intelligence	+3.0
Sociability	+2.2
Neatness	+1.8
Beauty	+0.2
Conceit	−1.7
Snobbishness	−2.0
Vulgarity	−4.2

On the whole, the tendency was to overestimate. Only in three traits was there an underestimation; 66 per cent under-

estimated themselves in vulgarity, 64 per cent in snobbishness, and 52 per cent in conceit. But this very underestimation reflects the tendency to give a better rating for oneself than is merited—*the underestimations occurred in the main in those traits which are undesirable.*

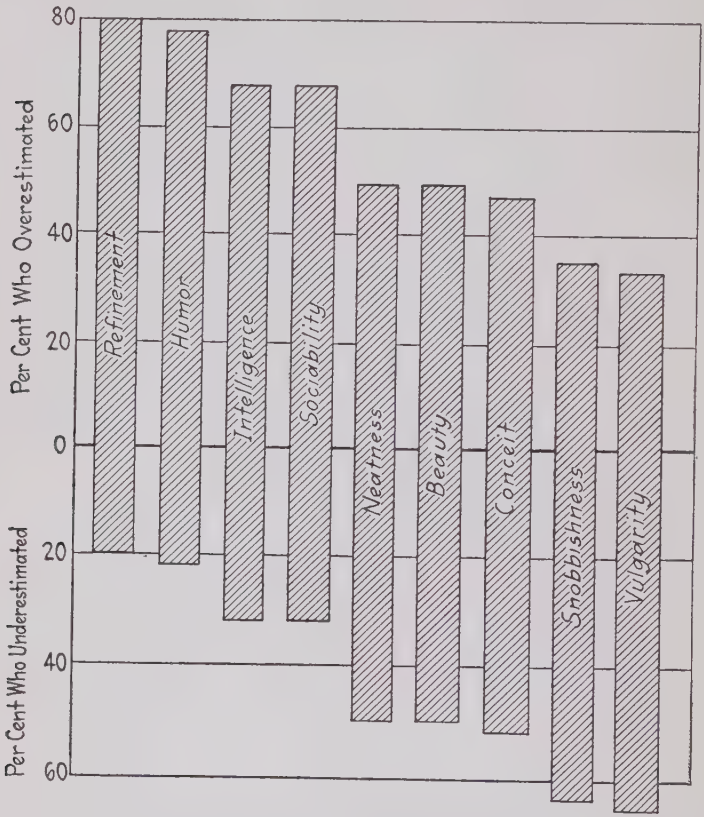


FIG. 63.—The human failing is for one to overestimate himself in favorable traits and to underestimate himself in unfavorable traits.

There is another peculiarity about self-estimates that is worth noting. Drs. Floyd H. and Gordon W. Allport made a study of this at the Harvard Psychological laboratory. They found that the person with high general abilities underestimated them, while the one with low abilities overestimated them. Their findings are illustrated in Fig. 64. In this figure each step represents an individual. The dotted line indicates their intelli-

gence scores, while the solid line shows their self-evaluation. Those with high general abilities are placed at the left of the figure. It is plain from an inspection of this figure that the high ones underestimated themselves while the opposite holds for the others.

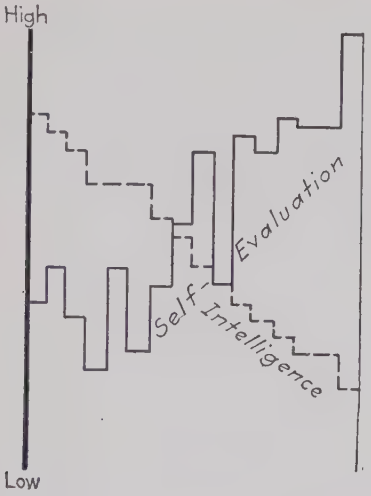


FIG. 64.—Those with low abilities overestimate themselves, while those with high abilities underestimate themselves. (Explanation in text.)

HOW WELL CAN PAST ASSOCIATES JUDGE THE APPLICANT?

No one except the person with a blindly optimistic faith in the infallibility of one's opinions of himself, accepts these opinions at their face value. Consequently, it is customary for the prospective employer to write to previous employers for information about the skill and behavior of the applicant while in their employ. Applicants usually are aware of this and carry, if possible, a well-worn letter from one or two past employers.

There are certain obvious dangers in these letters of recommendation which deserve mention, although it is a matter more of common sense than of psychology. These testimonials are usually of two general sorts, or each one has two aspects. One is concerned with what are usually termed character references; the other, business or trade references. What the reliability and validity of the character references are will be the first question to answer.

CHARACTER REFERENCES

There are two ways in which to check up on the accuracy of the estimates of character. One is by comparing the estimates of different judges (objectivity); the other is by checking off the estimates of the judges against known measures of the character traits under question (validity). Several investigations have been reported of the agreement of different judges in estimating the character traits of others. One of these, of considerable importance, was performed by Dr. James Burt Miner at the Carnegie Institute of Technology. He studied the estimates of the six character traits:

Common sense.
Energy.
Initiative.
Leadership.
Reliability.
General ability.

Persons about to be recommended "for positions ranging from civil engineer to actress, from plumber to musician, from architect to teacher" were rated on these six traits by persons who knew them well.[1]

[1] These six were chosen for study because they had been given highest ranks for significance in recommending one for a position out of a list of 300 traits. The traits given highest rank out of the entire list are of interest. They are given below, the number indicating the rank:

1. Common sense.
2. Judgment.
3. Initiative.
4. Reliability.
5. Efficiency.
6. Intellect.
7. Clearness of thought.
8. Understanding.
9. Accuracy.
10. Integrity.
11. Energy.
12. Technical skill.
13. Loyal.
14. Industry.
15. Moral.
16. Resourcefulness.
17. Foresight.
18. Thorough
19. Conscientious.
20. Leadership.
21. Ambition.
22. Perseverance.
23. Originality.
24. Tact.
25. Systematic.
26. Self-reliant.
27. Concentration.
28. Broad-minded.
29. Cooperativeness.
30. Courage.
31. Imagination.
32. Well informed.
33. Stability.
34. Careful.
35. Practical.
36. Enthusiasm.
37. Adaptable.
38. Memory.
39. Patience.
40. Observation.
41. Quickness.
42. Inquiring.
43. Aggressive.
44. Firmness.
45. Oral expression.
46. Presence.
47. Apprehension.
48. Profound.
49. Dignified.
50. Case of learning.

The ratings were made on the rating blank illustrated in Fig. 65. A dot was placed along the line after each trait in such a position that it indicated where the person being rated belonged in the rater's opinion. If John Jones, who is rated in the figure, was highest in common sense of all the group, a dot would be placed at the extreme right end of the line. But apparently John Jones does not belong there in the rater's judgment, for the dot is found located a little to the right of the middle fifth of the group, or the average. So on with the other traits. He is found in the fourth, 20 per cent of the group in energy, which means that,

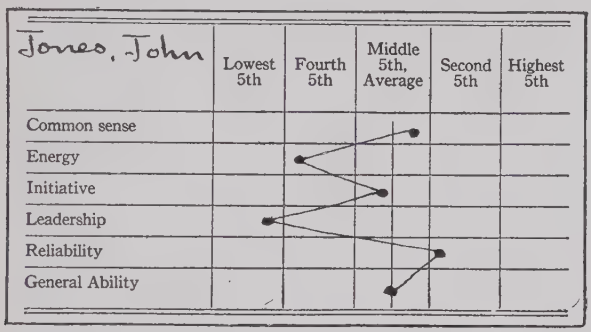


FIG. 65.—This rating scale was used by Dr. Miner in studying the reliability of reports on character traits.

out of a group of one hundred, he would be rated below the highest sixty in energy, and above the lowest twenty.

Using this careful procedure Dr. Miner obtained the ratings of 140 persons. Then he looked over his data to find out how certain he could be that other judges would give the same opinions of the persons rated. In sixty-four cases he compared the opinions of one judge with the opinions of another. He found that these agreed by the per cent better than chance indicated in the following tabulation:

Common sense	Energy	Initiative	Leadership	Reliability	General ability
16	26	15	23	5	15

The average agreement of these judges on all six of the traits was 16 per cent better than pure chance. This is far from a satis-

factory standard, such as is upheld for intelligence tests, for example, where one test agrees with another by at least 60 per cent better than chance.

Is the objectivity of character judgments increased when two estimates are combined? Data to answer this question are given below, in terms of the per cent better than chance agreement between the ratings of two judges with the ratings of two other judges in thirty cases:

Common sense	Energy	Initiative	Leadership	Reliability	General ability
21	38	26	36	29	35

Combining the ratings of two judges has plainly added much to the objectivity of the opinions of the character of the persons being rated. The average agreement, or objectivity, has increased from 16 per cent better than chance to 31 per cent better than chance. How great the increased objectivity is for each of the traits is shown in the following:

Common sense	Energy	Initiative	Leadership	Reliability	General ability
5	12	12	13	24	20

There is always safety in numbers and especially in rather loose ratings. As an illustration of this the following data, from Dr. F. B. Knight, are given. These data were obtained by comparing the agreement of the ratings of different-sized groups of teachers, in general ability as a teacher. The ratings of each half of the groups indicated were combined to give a "mass judgment" and then the agreement between the two halves compared. The row of figures to the left gives the size of the group; the row to the right, the agreement in terms of the per cent better than chance.

Size of group	Agreement
10	25
35	56
53	65

With an increase in size of the group of judges there is a decided increase in the reliability of the ratings although it must be admitted that the size of a group necessary for a reliable rating *obtained by this method* is so large as to be almost impracticable.

It is significant to note that with Dr. Miner's careful scheme the objectivity of two combined judgments was 32 per cent better than chance, while with the procedure used by Dr. Knight ten combined judgments had an objectivity of only 25 per cent better than chance. The teachers were merely arranged according to the way it was thought they possessed general teaching ability whereas, in the rating scheme used by Dr. Miner, a more rigorous judgment was given. This is of considerable importance in pointing out a possible hope for hitting upon a method of rating character traits that will be of considerable objectivity.

For the present, however, it is apparent that in all practical situations the judgments of *at least* two raters should be combined to give a reasonable objectivity. For a desirable objectivity it is probable that at least four independent ratings should be combined. This is in case a fairly objective rating scheme such as has been described is used, and that those who are judging have a good acquaintance with the individual they are rating. In case a formal letter is written it is difficult to know how many are needed to give even a reasonable objectivity.

In Fig. 66, a chart is presented showing how a rating scheme such as that used by Dr. Miner differentiated two members of the 140 who were rated. It will be noted that Roscoe on the whole is rated much higher than Franklin; Roscoe being in the upper half of the group in all of the traits except reliability, while Franklin was consistently near the bottom in all the character traits. It may be assumed that the differences between these two were not due to chance differences incident to the unreliability of judgments of this sort. If the differences between these two were less, there could not have been much certainty. How

great the differences should be before serious regard is given will be taken up shortly.

The ratings of any individual judge are likely to be erroneous to a marked degree, but the individual judge is consistent (reliability). Dr. Naomi Norsworthy found that ratings made by

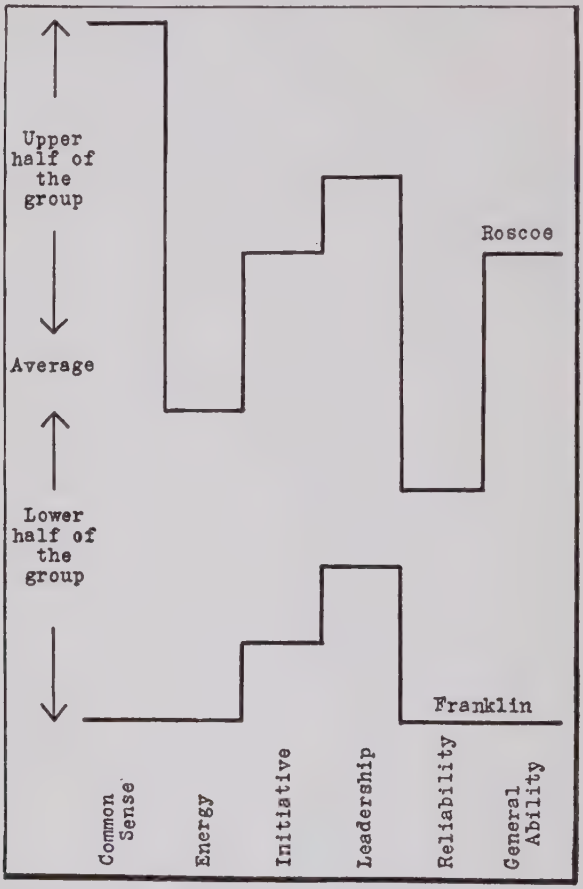


FIG. 66.—A chart of the character traits of two engineers about to enter industry.

the same judge of the same persons, but separated by an interval of several weeks, were very much the same. This consistency does not add value to the ratings; the rater may be consistent but wrong. This militates against the occasional practice of having the same employees rated by the same superiors at stated intervals.

Are the Estimates of Acquaintances Valid?—Even if there were perfect agreement among the judges, there is a possibility that they might be completely wrong. Were this the case the objectivity would be high but the validity of the estimates would be zero.

Instances such as these may be the exception, but their occurrence at times is not to be neglected. An interesting illustration has been reported by Dr. Harold Rugg in his studies of the army rating scales.

> Captain X was so well known and was so conspicuous in his group that he was used by thirteen officers on twenty different subordinate scales—physical qualities, intelligence, leadership, etc. On each of these twenty scales he was elected to be "the poorest man I ever knew." Furthermore, he was so very conspicuous that three officers used Captain X as the lowest man on four out of five of their scales. To them he was so outstandingly a weak man that there was no question of using another fellow captain for the lowest position on the different scales.
>
> Now consider the objective measures of his abilities. *On three different psychological tests; Captain X was first ranking man among* 151 *officers.* He scored 206 out of a possible 212 in the Army Alpha test. He scored 151 and 144 respectively on two forms of the Thorndike Alertness Test . . . Moreover he had been regarded only a few years before as an all-around man for he was a Rhodes Scholar at Oxford from a middle-western state university. At Oxford he made such a record that he was excused from certain examinations. *Here then is a startling example of divergence between ability-to-do and our judgment of it.*

In an earlier chapter (pages 104 to 107) experiments were reported of the validity of similar estimates.

What Traits Can Be Estimated with Most Objectivity?—The study by Dr. Norsworthy, which has already been mentioned, and another by J. McKeen Cattell, reported estimates on twenty-three character traits. Although each study was made independently, the same list of traits was used in both. In the following tabulation these traits are listed according to the objectivity with which they were estimated by the judges. Objectivity, it will be recalled, means agreement with the other judges and not necessarily agreement with the actual traits of the person being rated. In the long run, where there is considerable agreement among the judges, they are probably pointing in the right direction. In the table the figures give an index of

the agreement of the judges, a low figure indicating close agreement, a high figure, disagreement:

Trait	Coefficient of agreement
Efficiency	83
Originality	86
Perseverance	88
Quickness	89
Judgment	89
Clearness	90
Energy	91
Will	91
Mental balance	96
Breadth	96
Leadership	96
Intensity	99
Reasonableness	100
Independence	101
Refinement	103
Physical health	103
Emotions	105
Courage	109
Unselfishness	110
Integrity	117
Cooperativeness	119
Cheerfulness	121
Kindliness	123

In the first eight traits in the table the agreement of the judges is fairly close; in the last six traits the *dis*agreement is marked. The practical implication of this is to discount especially all reports in which the last six are mentioned, and give more reliance to the first eight. In the blanks which are mailed to previous employers, there is no special point to include the traits given in the lower half of the list since reports on these have but little objectivity.

It is in the traits in which the reaction or response to others is reported that agreement is least. Unselfishness, cooperativeness, and kindliness are traits in which there is little agreement. They are also traits which represent the individual's reaction to

other persons. The report in a testimonial on such traits as these depends as much, or even more, upon the character traits of the person making the rating as it does upon the person being rated. Cooperativeness is as much a matter of the rater as it is of the worker, hence the great lack of agreement in the reports.

On the other hand, such traits as originality, quickness, and the others in the first eight, do not represent the reactions of the person being rated to other individuals. The result is that the objectivity of the ratings is increased. It is well to bear this difference in mind continually. Ratings, judgments, and reports which are based upon reactions to persons are always very unreliable. It may be desirable to know about the cooperativeness of an applicant, but one can scarcely be certain from the reports of his past associates.

Dr. Edward S. Jones has reported more recently a somewhat similar study from the University of Buffalo and Oberlin College. This was an extensive investigation of eighty descriptive terms such as loyal, trustworthy, diligent, and so on. The particular eighty terms studied were selected because of the great frequency of their appearance in letters of recommendation. There is an added value to this study inasmuch as men and women were studied separately, men rating men and women rating women. Fairly high agreement was reported for the following traits:

MEN

Ability.
Adaptable.
Breadth.
Dependable.
Diligent.
Expresses self well.
Hard-working.
Industrious.
Initiative.
Kindly.
Leadership.
Loyalty.
Maturity.
Neat.
Popular.
Reliable.
Respected.
Scholarship.
Sensible.
Steady.
Wholesome.

WOMEN

Ability.
Alert.
Bright.
Capable.
Careful.
Earnest.
Forceful.
Hard-working.
Honest.
Influential.
Keen.
Modest.
Popular.
Scholarship.
Sincere.
Willing to work.

In the following character traits, only a moderate agreement was found:

MEN

Accuracy.
Agreeable.
Altruistic.
Appearance (good).
Attractive.
Capable.
Careful.
Conscientious.
Determined.
Energetic.
Enthusiastic.
Executive ability.
Faithful.
Friendly.
Genial.
Healthy.
High ideals.
Honest.
Influential.
Intelligent.
Interested.
Judgment.
Keen.
Modest.
Originality.
Painstaking.
Persistent.
Pleasant.
Prompt.
Quiet.
Refined.
Responsible.
Social mixer.
Tactful.
Thinker.
Thorough.
Thoughtful.
Trustworthy.
Will succeed.
Willing to work.
Winning personality.

WOMEN

Accuracy.
Agreeable.
Altruistic.
Ambitious.
Appearance (good).
Character.
Charming.
Cheerful.
Conscientious.
Cooperative.
Diligent.
Efficient.
Enthusiastic.
Executive ability.
Expresses self well.
High ideals.
Healthy.
Industrious.
Initiative.
Inspires confidence.
Intelligent.
Interested.
Judgment.
Kindly.
Loyalty.
Maturity (thought).
Painstaking.
Persistent.
Pleasant.
Poise.
Prompt.
Refined.
Reliable.
Respected.
Responsible.
Sensible.
Social mixer.
Tactful.
Thinker.
Wholesome.
Will succeed.
Winning personality.

In the following the agreement was very slight:

Men	
Alert.	Efficient.
Ambitious.	Forceful.
Bright.	Independent.
Character (strong).	Inspires confidence.
Charming.	Poise.
Cheerful.	Resourceful.
Cooperative	Sincere.
Dignity.	Unselfish.
Earnest.	Vigorous.
Women	
Attractive.	Leadership.
Adaptable.	Neat.
Breadth.	Originality.
Dependable.	Quiet.
Determined.	Resourceful.
Dignity.	Steady.
Energetic.	Thorough.
Faithful.	Thoughtful.
Friendly.	Trustworthy.
Genial.	Unselfish.
Independent.	Vigorous.

This list of eighty terms from Dr. Jones' work can serve as a dictionary of objectivity by which the significant portions of letters of recommendation can be judged. Combined with the terms listed immediately preceding, the executive is fortified with a guide and a check upon his own estimates of character as well as the estimates he has received from others.

As a by-product of this work it was noted that men rating men tend on the whole to rate higher than do women rating women. The men also agree better, indicating greater objectivity in their ratings. Some of the terms most used in the references from which the list of eighty was culled are low in objectivity. Such terms are faithful, attractive, good judgment, conscientious, character, enthusiasm, earnest, and reliable. Although these terms were used with great commonness in the letters of recommendation studied, nevertheless, they were not above the average in objectivity. "In other words, the fact that a term is commonly used is no guarantee that there is agreement in its use."

Can "Good Acquaintances" Judge Better?—A common-sense precaution that is usually taken in evaluating letters of recom-

mendation is to ask the writer how long he has known the person he is writing about. As a matter of fact the longer acquainted one is with the person he is recommending the poorer his estimates are. Study of the ratings of 1,048 teachers in the public schools demonstrates this clearly. In Fig. 67 the ratings assigned to teachers who had been known for varying lengths of time are given. The longer the teachers have been known by the person who is grading them, the higher the estimates of their general efficiency. Over 65 per cent of those who have been known for 8 or more years are estimated to be excellent in general efficiency; while, teachers who have been known for only a year or less have less than 10 per cent of their number judged excellent in the same traits.

Commenting upon this Dr. F. B. Knight says:

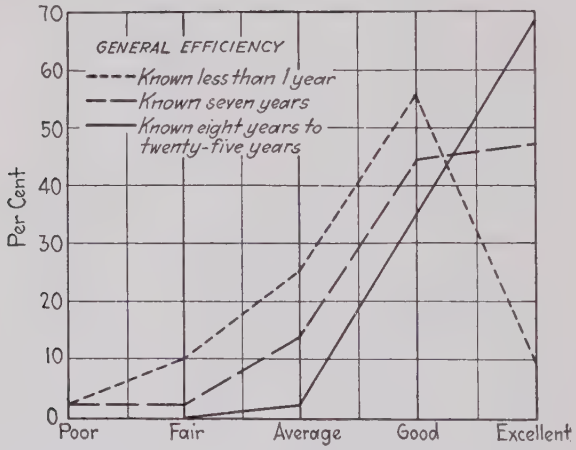


FIG. 67.—Long acquaintance does not mean more valid estimates of character traits, it merely makes too favorable estimates. (Explanation in text.)

. . . the *amount* of overrating seems to be a function of the "acquaintance factor." There is little reason for uneasiness in the fairness of this conclusion. The other apparent explanation is that as teachers gain experience they do gain in power, and so the ratings reported represent the facts. This is hard to believe for two reasons. First, several published studies upon the effect of the length of experience upon skill in teaching report but little relationship between length of experience in amounts implied here and skill in teaching. Secondly, the explanation of the data is true because one judging only by length of experience would have to assume that length of acquaintance was a reliable measure of length of experience. It is not . . .

If one were tempted to explain the reasons for this overrating the following three considerations may be found to be a part of the total explanation.

1. A supervisor could hardly admit . . . that "being under his direction" brought no improvement . . . All of us are familiar with the mixed truth of such statements by a supervisor as this: "Teacher A was pretty poor when I got her but I have developed her into a first-class teacher."

2. . . . unconscious identification. Older teachers are more like supervisors themselves, at least in age . . . An instance of a teacher's rating being affected by the bias of the supervisor is reported by Superintendent Reed, of Akron, Ohio. He asked each principal to give the name of his best teacher and why that teacher was best.

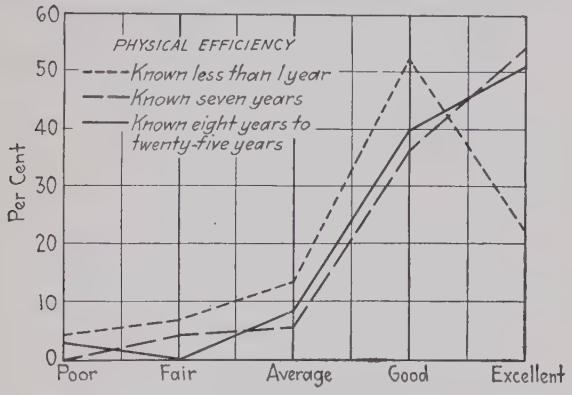


FIG. 68.—This shows the tendency for one to over-judge the physical efficiency of persons that have been known for a long time. (*Data from Dr. F. B. Knight.*)

Principal A gave as the reason for superiority in his choice, "He is a he-man."

Principal B gave as the reason for superiority in her choice, "She holds up high ideals before her pupils."

Principal A is an ex-athletic director. Principal B is an inveterate Sunday School worker. Identifying superiority in teachers with the judge's pet hobby seems to be operating here.

3. Negative adaptation to persons as well as to environment is a possible explanation. We get used to people. Quirks of mannerisms, annoying at first, soon lose their potency. Teachers who have become fixtures are accepted while new teachers are still on trial. Little mistakes, different ways of doing things, not "knowing the ropes," and other evidences of newness may affect the supervisor's judgments of new teachers far more than they affect the efficiency of classroom instruction . . . The consistency of improvement in the ratings for Physical Efficiency (Fig. 68), as teachers get older, is a

good case in point. No one would contend that the older a teacher is the more vitality and physical efficiency she has.

The data support the contention, that after allowing generously for increased efficiency due to experience, there remains a Factor of Acquaintance which tends to make the judge more lenient in proportion to the length of time he has known the person judged.

The quotation has been given at length because of the importance of the points that are made. "Worker" or "mechanic" or "clerk" could have been substituted in the quotation every time the word teacher appeared. For supervisor or principal "foreman" or "manager" could have been inserted. The situation is the same in a factory or plant as in the school system. "*Knowing the applicant too long apparently decreases the critical value of the judgments.*"

It is possible for one to have been acquainted a long time without having been intimately acquainted. Dr. Harold Rugg studied the effect of *intimacy of acquaintance* rather than length in connection with the rating of the personal traits of army officers. He says:

> The data that we studied during the investigation were impressively pointing toward the conclusion that estimates of human character depend closely upon intimacy of acquaintance and that it is important to evaluate the competency of the rater.

In obtaining information regarding applicants, it would therefore appear to be better practice to cross out the question: "How long have you known the applicant?" and in its place ask: "How well have you known the applicant?"

DO WE ESTIMATE SPECIAL QUALITIES IN OTHERS OR GENERAL IMPRESSIONS?

Another error that is fairly consistent in judgments of character traits arises from our inability, without special training and effort, to separate the different elements such as leadership, cooperativeness, and reliability from our general estimate of the person. It had been established that if one thinks highly of a person all the traits in which he is judged are estimated with undue favor. On the other hand, if one has an unfavorable general impression, it is difficult impartially to analyze the different elements and not underestimate them. The result is that, although one believes he has rendered an unbiased judg-

ment of the person's character, what has really been given is an estimate influenced by his general estimate.

Dr. E. L. Thorndike, of Columbia University, called attention to this after a study of the employees of two large industrial corporations in 1915. He said:

. . . it appeared that the estimates of the same man in a number of different traits such as intelligence, industry, technical skill, reliability, etc., were very highly correlated and evenly correlated. It consequently appeared probable that those giving the ratings were unable to analyze out these different aspects of the person's nature and achievement and rate each in independence of the others. Their ratings were apparently affected by a marked tendency to think of the person in general, as rather good or rather inferior, and to color the judgments of the qualities by this general feeling.

SHOWING TYPICAL SITUATIONS AND REACTIONS INVOLVING SELF-ASSURANCE

Situations	Reactions Other Factors Being Equal	Negative Responses
1. A new situation demanding response.	Undertaking with readiness, carried out beyond demands.	Excessive inquiry—and waiting for directions.
2. A new situation inviting response.	Ready acceptance.	Declined; or needing stronger invitation.
3. Many tasks inviting response.	Acceptance of many.	Carrying a light load.
4. A task demanding preparation.	Tendency to undertake without thoro preparation.	Careful preparation.
5. A task recognized as imposing, difficult.	No hesitation, total engagement, not half-hearted attempts.	Hesitation—partial performance.
6. Responsibility offered.	Accepted.	Avoided
7. Responsibility not offered.	Sought—opportunity made.	Not desired—probably not thought of.
8. Opinion asked.	Readily given.	Modestly withheld or qualified.
9. Estimate of one's own qualities called for.	Given with little delay.	Long pondering.
10. Selection, preferences called for.	Speed of decision.	Slow, wavering decisions.
11. Estimate of one's own capacity to perform certain tasks called for.	Selection of material near limit of capacity, or over-estimation.	Under-estimation.
12. Contradicted when asserting one's own memory of an event, act, etc.	Denial of error.	Acceding.
13. Contradicted in personal convictions by authority and by associates.	Maintenance of conviction (not necessarily public expression).	Suggestible (Re matters of opinion.)

FIG. 69.—A list of typical situations and responses which indicate the presence or absence of self-assurance are given here. This greatly increases the value of ratings. (*From Dr. R. O. Filter.*)

It is impossible to overcome this vague "halo" in such estimates without recourse to some list of descriptive phrases that will serve to differentiate such a term as "cooperativeness" from "ability." How would you now, for example, rate your workers or your associates in such a trait as self-assurance? Admittedly, it would be difficult. But if you check each of them on the twelve different situations such as are given in Fig. 69, the task not only becomes easier but, what is more valuable, the estimate

will not be so much one of a general impression as it is one of self-assurance.

In all estimates where it is desired to have more than chance value, it is imperative to supplement the mere mention of a trait with a description of the types of behavior indicating the presence or strength of the trait under consideration.

Some Judges Are "Easy."—In estimates of the moral traits of others all judges are too lenient. In other judgments, some are easy and some are strict. Dr. W. D. Scott has found, however, that there are some who consistently estimate the character traits of others too high. Figure 70 shows that even when a fairly accurate rating scheme, such as will be described in the

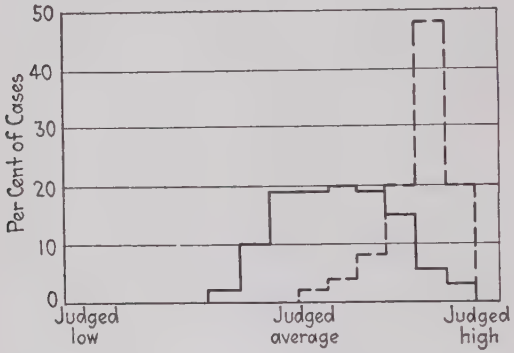


FIG. 70.—The foreman indicated by the dotted line judged too leniently. It is necessary to know the judge as well as the applicant to evaluate testimonials properly.

second chapter following, is used, one foreman tends to estimate unusually high.

This is of much practical importance, for it may mean that an unusually flattering recommendation indicates an easy judge rather than an excellent worker. This is a variable error which must be taken into consideration in all estimates of employees.

Some way of adjusting judgments for the personal equation of the judge must be found.

Employment practice is by no means limited to getting the right "slant" on new workers. For many reasons the higher positions are often filled from the ranks. Professor E. B. Gowin made a survey of twenty-one firms with this point in mind and found the data given in the following table:

RESPONSIBLE POSITIONS FILLED FROM WITHIN THE RANKS AND FROM OUTSIDE SOURCES[1]

Department head	Promoted from subordinate position	Transferred from another department	Secured from outside the firm
Purchasing agent	4	2	0
Factory superintendent	2	2	3
Employment manager	1	1	0
Chief accountant	5	0	1
Office manager	2	1	0
Credit manager	2	1	1
Sales manager	6	1	0
Advertising manager	1	2	1
Higher officials:			
General manager	4	3	0
President	6	7	4

[1] Data from the following firms: American Brass Co., American Steel Foundries Co., American Stove Co., American Vulcanized Fibre Co., American Writing Paper Co., Automatic Electric Co., Borden's Condensed Milk Co., Buick Motor Co., Consolidated Wagon and Machine Co., Colorado Fuel and Iron Co., Gottleib-Bauernschmidt-Strauss Brewing Co., J. I. Case Threshing Machine Co., Indian Refining Co., Locomobile Co., New York Dock Co., Pittsburgh Plate Glass Co., Standard Sanitary Manufacturing Co., Standard Underground Cable Co., The Studebaker Corp., United States Envelope Co., United States Gypsum Co.

Only ten out of sixty-three of these positions had been filled from outside the company. Those workers who were promoted had undoubtedly been under observation for years. How much of this observation had been used upon chance and hobbies one can only conjecture. Obviously, accurate records would be preferred to random impressions and very likely chance observations.

There is the employee's salary record, but in many firms there is no record kept of the raises in salary. When an employee is considered for promotion, is there available a fairly complete record of his past with the firm? Is there a record for ready reference of his accidents, his spoiled work, his output per hour, his absences, his quarrels with other workers, his dissentions with superiors, his popularity, his complaints, and innumerable other significant things that tend to be forgotten if they are not recorded regularly by the foremen or supervisors? Some of these are a matter of actual fact, such as spoiled work, absences, and quarrels. Others are matters of estimates such as popu-

larity, attitude toward the firm, and aggressiveness. Of course these estimates are liable to considerable error, but even with their pitfalls they are immensely more valuable than mere opinions mustered together at the moment promotion is being considered.

Every foreman should have among his duties the regular recording, at the close of every work period, of significant events centering around particular employees. A special "Foreman's File" of cards known as "Foreman's Record" should be available for this purpose.

When the employee is transferred to another department, the card should follow him and the daily record be continued. When the time comes for promotion or recommendation to another company, there will be this card in the files with its unerring memory.

Another advantage inherent in such a record system is that the records give much insight into the abilities of the foremen. If the superior notes that a foreman has many records of "dispute with foreman" on his cards, it is indicative of lack of ability to handle men properly.

In addition to this daily record of significant happenings there should be recorded at stated intervals a careful "character rating" of the employees. In many firms this is a routine matter at present. There are many obvious advantages, both theoretical and practical, arising out of such routine procedures as these. They may be summed up by stating that there is always available accurate records of earnings, spoiled work, arguments, absences, insubordination, and other objective facts of importance to be considered in promotion and in recommending to other firms. In addition there will be fairly reliable character estimates that have been reached in cooler moments than in those that accompany discharges and resignations. Unless there are live records of these sorts, the employee's past is almost a chance affair so far as the employer is concerned. How to keep the element of chance at a minimum in the records of employees will be our next concern.

CHAPTER IX

MEASURING THE SUCCESS OF EMPLOYEES

"That is Kennedy at the bench in the corner. He is one of our best workers; been with us since he was sixteen." The plant superintendent related other things about Kennedy, which revealed a lively concern in the welfare of the employees; but the fact to be proved is whether or not he was one of the best workers.

What did this plant superintendent mean by "one of our best workers?" What does any employer mean by similar assertions?

Employees Average Piece Work Earnings

Name..... Dept..... Clock No.....

Week Ending	Total Piece Work Hours	Total Piece Work Earnings	Average Piece Work Rate	Week Ending	Total Piece Work Hours	Total Piece Work Earnings	Average Piece Work Rate
JAN.				APR.			
TOTALS				TOTALS			
FEB.				MAY			
TOTALS				TOTALS			
MAR.				JUNE			
TOTALS				TOTALS			

FIG. 71.—When a foreman keeps file of production record cards such as this there is little guessing about which is the better worker. A column for spoiled work would increase the value of this one.

Industry centers around the worker. This is an age of machine-made products, but still the output of the machines remains dependent upon the worker. This is well demonstrated by the experience of a group of English textile mills with looms that were automatons of perfection. To the operators it appeared that production was dependent solely upon the machine. So it would appear to the observer who watched these marvels of ingenuity weave yard upon yard of cloth, Robot-like. So it appeared to a board of government scientists until they had

compiled data from these same machines for several months. Then it was found that the efficiency of each loom and the output of the factory depended not so much upon the mechanical perfection of the machine as it did upon the abilities of the workers in charge of the looms.

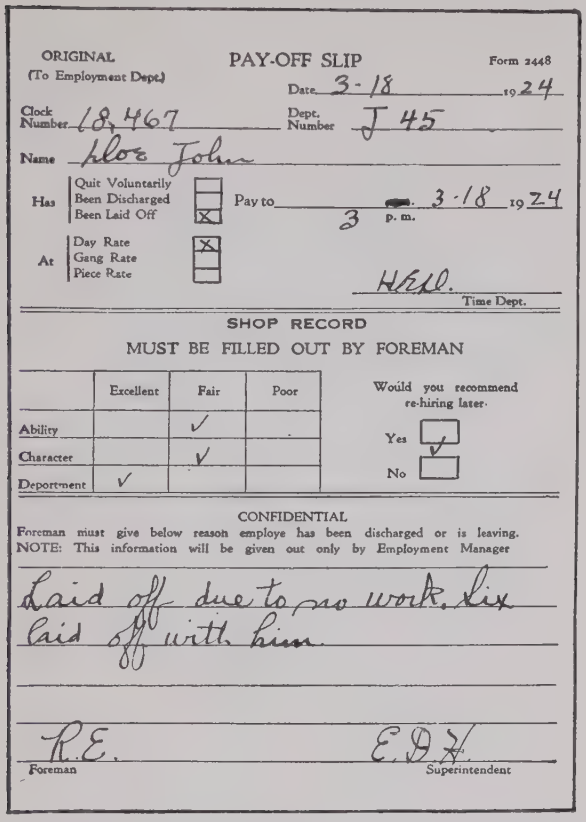
The first step in employment psychology is to find the successful employee, regardless of the angle from which it is considered. Looked at as the placement of applicants, the tasks of employment psychology is to find out, with scientific certainty, whether or not each applicant will be successful in a given job. But before this can be done, the characteristics of the successful employees in the different processes and operations must be known. This in turn demands the knowledge as to which employees are successful. Unless this basic information is at hand and is properly studied, selection will remain largely a chance affair.

THE FAILURE OF EMPLOYEE ACCOUNTING

Most employee accounting gives little insight into a plant. Average daily force in different departments, turnover, accidents per thousand hours risk, time absent for various causes, and total additions can all be easily obtained from plant records, but their value stops almost as soon as they are put on paper. They may indicate that something is the matter, but only rarely do they show just what is wrong or how to correct the fault.

It is individual output per bench-hour that is of most value in a *diagnostic* employee accounting. An example is a modern shoe factory. When it is reported that during the past fiscal year the output per employee-hour in the consol lasting department was fourteen pairs, while for the previous year it was seventeen pairs, the management is immediately informed that something is wrong. As soon as the accounting further takes up the hourly output of the individual employee and it is found that one has an output of twenty-eight pairs, while another, with the same experience, produces only ten pairs, insight is given into a very important causative factor in the past year's decreased output. This is a *bona fide* example.

Individual differences, as revealed by a complete employee accounting, will not always account for all the decreases and increases in output. Working conditions and methods, a change in materials or machinery, may bring about changes that are



ORIGINAL
(To Employment Dept.)

PAY-OFF SLIP

Form 2448

Date 3-18 1924

Clock Number 18,467 Dept. Number J 45

Name Hloe John

Has — Quit Voluntarily / Been Discharged / Been Laid Off [X]

Pay to 3 p. m. 3-18 1924

At — Day Rate / Gang Rate / Piece Rate [X]

HELD.
Time Dept.

SHOP RECORD
MUST BE FILLED OUT BY FOREMAN

	Excellent	Fair	Poor
Ability		✓	
Character		✓	
Department	✓		

Would you recommend re-hiring later.
Yes [ ]
No [✓]

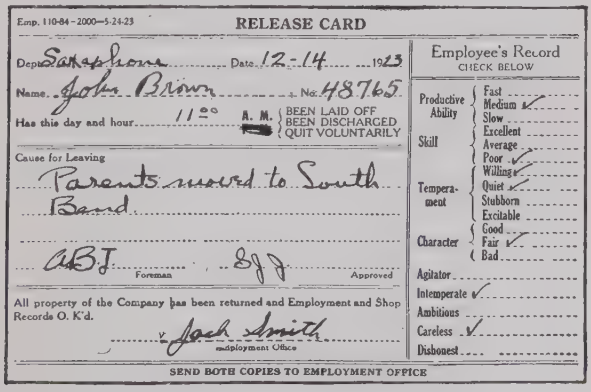
CONFIDENTIAL
Foreman must give below reason employe has been discharged or is leaving.
NOTE: This information will be given out only by Employment Manager

Laid off due to no work. Six laid off with him.

R.E.
Foreman

E.D.Y.
Superintendent

FIG. 72.—This blank used by an automobile manufacturer records information about character traits only when workers are leaving the service.



Emp. 110-84-2000—5-24-23

RELEASE CARD

Dept. Saxophone Date 12-14 1923

Name John Brown No. 48765

Has this day and hour 11 A. M. { BEEN LAID OFF / BEEN DISCHARGED / QUIT VOLUNTARILY

Cause for Leaving
Parents moved to South Bend

ABJ
Foreman

BJJ
Approved

All property of the Company has been returned and Employment and Shop Records O. K'd.

Jack Smith
Employment Office

SEND BOTH COPIES TO EMPLOYMENT OFFICE

Employee's Record
CHECK BELOW

Productive Ability	Skill	Fast
		Medium ✓
		Slow
		Excellent
		Average
		Poor ✓
Temperament		Willing ✓
		Quiet ✓
		Stubborn
		Excitable
Character		Good
		Fair ✓
		Bad
Agitator		
Intemperate ✓		
Ambitious		
Careless ✓		
Dishonest		

FIG. 73.—This manufacturer of musical instruments also records character traits only when workers leave his employ. The record, however, is better than the one shown in Fig. 72.

reflected in the production rates. Those are questions, however, of the psychology of working efficiency and fatigue, and of mechanical engineering, and not of employment psychology. Since, at present, employment psychology is to be considered, these aspects of production will be passed over until later. It is always a safe and profitable policy to assume that variations in total output of a department are reflections of individual variations in the workers who have entered and left that department. The employment engineer should direct his attention to finding the exact status of each worker, and determining the degree of success in his work. An analysis of the ways of doing this must be made in the light of scientific methods and experiences so that serious, but not, obvious, error may be avoided.

THREE FACTORS IN EMPLOYEE SUCCESS

There are three different approaches to ascertain the degree of success of an employee. One, and the most apparent, is

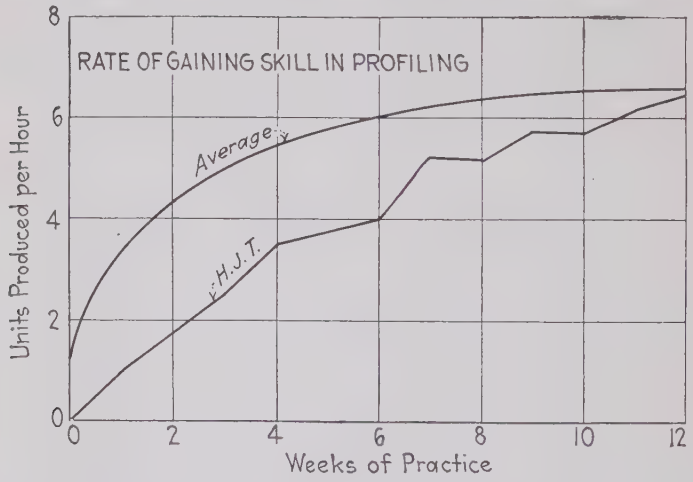


FIG. 74.—Employes have varying degrees of success in "getting on" just as they have different success after years of experience. This shows how real the difference is in machining operations.

to answer the question, "What kind of a worker is he *now?*" Another, which is commonly overlooked, is, "How much has it cost to make him the success he is?" This is a matter of rapidity of learning; the former, a matter of his present proficiency. The first is his value to the firm at his work this year; the other, his expense to the firm while "getting on" at his trade or task.

The third is how long he remains with the firm. (See Figs. 74, 75, and 76.)

The rapidity with which the worker has progressed is a real factor to be considered in establishing his total value to the firm. There are marked differences in learning ability which are too commonly passed by. How real and how marked these are is shown in Fig. 74. In this chart, the one curve represents the average progress of beginners at profiling. An average of about 7 weeks is required to reach maximum proficiency in this operation. But one worker, H. J. T., who is indicated by the other line, did not reach this level of proficiency until after 11 weeks of employment. From that time on, his success was up to the average, but for weeks his output was below normal. During the first 12 weeks his output was below normal. During the first 12 weeks he produced 742 units less than the average. This was a loss to the firm which should be charged against him in computing his total success. Illustrations of this point could be multiplied almost without end. The best illustrations, however, are to be found by an examination of the employees' records in any plant in which access may be had to them.

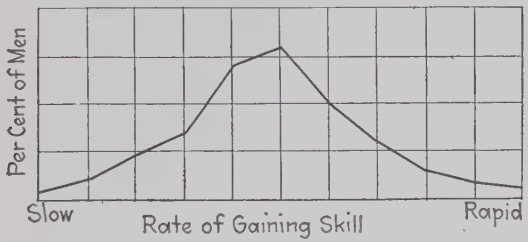


FIG. 75.—A distribution curve of the rate of gaining skill in sorting, such as is done by an inspector. The slowest took five times as long to learn as did the fastest. (*Data from Dr. W. H. Pyle.*)

PRECAUTIONS IN JUDGING SUCCESS

One cannot sit down and casually examine payroll records and be justified in believing that he has found the successful employees. Complex problems seldom have a simple solution. Finding the successful workers seems to be an easy problem, but in most cases the reverse is true. Unless certain well-founded principles are followed the results will be of negligible value. Failure to follow the three cardinal principles which have been emphasized has resulted in many incorrect conclusions. In a number of cases where psychological tests have failed in selecting

employees, the cause was that these tests were developed for such use by checking them up against measures of success which, although stated in figures, were valueless when judged by the principles of objectivity, reliability, and validity.

As corollaries to these principles it can be stated that:

1. The objectivity, reliability, and validity of a measure is low when it is based upon general impressions, usually too low to justify its use in any way, and that:

2. They are also, as a rule, too low to have any utility when based upon reactions of human beings to human beings as in raw measures of such traits as loyalty and cooperation. Conversely, it may be stated that:

3. They are high in measures which reflect values that have been, and can continue to be, obtained in physical units such as

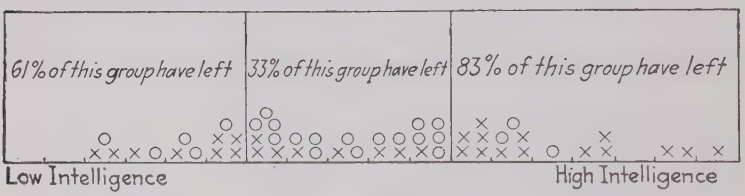


FIG. 76.—Length of service should be predicted. This shows how persons with too much general mental ability do not remain long as a clerical worker. A circle indicates a clerk who remained for at least 30 months, a cross those who left the work before having that much service. (*Data from Bureau of Personnel Research, Carnegie Institute of Technology.*)

pounds, yards woven, pairs completed, goods sold, and dollars earned. A further corollary may be added, to the effect that:

4. They are highest when measured by mechanical means, such as a counter or a meter.

Experience, in general, as well as scientific judgment, indicates that conclusions relating to employment cannot justly be drawn from data resting upon measures that neglect corollaries 1 and 2. In more positive terms it may be said that measures of success should always be obtained in the ways indicated by corollaries 3 and 4. If these two methods cannot be used, the work should not be started, for it will in all probability be valueless if completed.

As a specific example of this, take the experience in the employment work of a large department store. Considerably more than a year was spent in devising a series of tests that would select the sales clerks in close agreement with their success *as*

estimated by the supervisors. This scientific work which, however, was founded upon shifting sands, was published in a technical paper at great length. Then a department store in Philadelphia tried to use the tests, with contradictory results. This led to a re-investigation in the store in which they had been developed with results which demonstrated that, while the tests themselves were objective, they failed to pick the potential successes consistently because the measures of success used were practically devoid of any objectivity.

These three principles cannot be neglected without seriously invalidating all conclusions, regardless of whether one is working in mechanical or human engineering. Values that are constant and universally applicable can be obtained only if these are followed.

FIG. 77.—Stitches sewn can be recorded by a counter such as this one.

WHAT SORT OF A WORKER IS HE NOW?

Output Measures.—Direct measures of output can usually be obtained that are of use when checked up by the three principles. In some office and executive positions, difficulties are encountered,

since only indirect measures of sufficient reliability and objectivity to warrant their use can be obtained. The validity of these is often open to question. Such indirect measures of success are turnover, labor cost per unit of product, and the number of complaints. In the case of most employees, direct measures can be obtained of the number of articles completed or operations performed. These direct determinations are not without their pitfalls as will be shown.

Output Dependent on Others.—The determination of individual success, as in the case of workers in tinplate mills, is often impossible, since teams of four or more work together, the output of one worker being dependent upon the output of the others. Thus the slowest man sets the pace. As a rule great economies could be effected by discovering the pace-maker. How this dependence upon others may affect output is shown by the following data from laundry workers engaged in folding table-cloths:

	Seconds to fold one table-cloth
Worker A with B	16.3
Worker A with C	22.0
Worker A with D	16.1

In an 8-hour day workers A and B, as a team, could fold 1,788 table-cloths, while workers A and C, as a team, could fold only 1,309, a difference in output of 479 pieces. It is obvious that this decrease in production should not be checked off against the success of worker A; and before the relative success of any worker in teamwork can be found, it is necessary for the personnel of the teams to be shifted so that the individual differences can be brought into relief.

Output Limited by Extraneous Factors.—It has been stated that apparently self-sufficient automatic machines are not always independent of an operator in their output. Conversely, individual output is often disturbed by mechanical factors which are not related to the working ability of the worker. A poor supply of coal will lower the output of a blast furnace, but this decrease is not a reflection upon the workers themselves. The

operator of a loom near a door that is being opened and closed during the day, thus admitting chilly air, will have her output lowered because of the increase in yarn breakages directly due to the entrance of cold air. Factors such as these lower the validity of measures of success and should be given careful consideration.

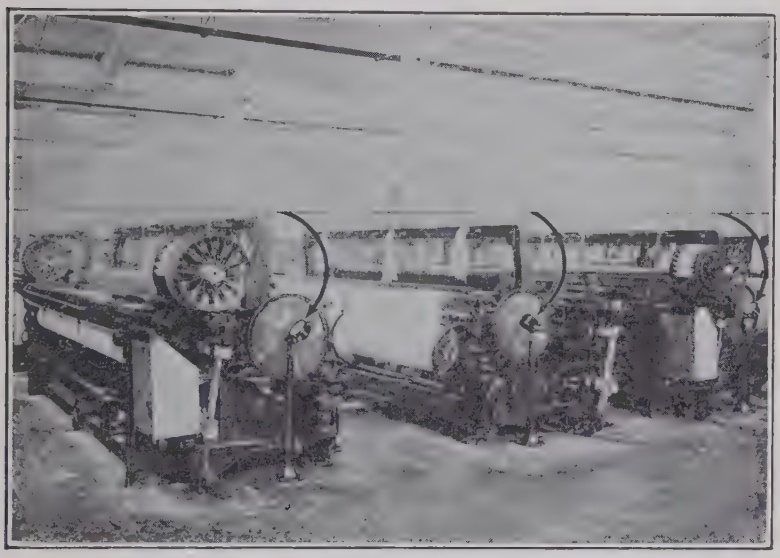


FIG. 78.—Mechanical counters are in use counting the "picks" in textile plants. (See page 175.)

Mechanical Measures of Output.—In plants working under a piece-rate system output records are readily available. When they are not, they can usually be obtained with the aid of simple mechanical devices. The output of loom operators, for instance, can be mechanically ascertained by a "pick" or yardage counter, the reading of which requires but a moment weekly or monthly. Mechanical counters are in use on punch presses, printing presses, and conveyers.

The reliability and objectivity of mechanical devices such as these are undoubtedly of the highest. At times their validity may be open to question, largely due to the selection of the unit of measurement (see Figs. 77 and 78).

The Unit of Measuring Success.—Counters are available for attachment to the space bar of a typewriter so that, each time the space bar is pressed in making a space between words, a

count is registered of the total number of words written. (Fig. 79.) There are some difficulties in the way of employing this method to measure typists' success. First of all, there is a danger that the typist may give a fallacious record by inserting an extra space from time to time. There is a possibility of this being done intentionally in an attempt to "pad" the output record. Whether intentionally done or not, there is the lessened validity due to the excessive use of the space bar in paragraph indentations, tabular matter, addresses, and headings. The total number of counts on the counter does not represent words only. If they did, there is still the fact that words vary in length. The

FIG. 79.—A mechanical counter gives an unprejudiced record of a typist's success.

typist for the executive who is given to the use of long words would be unduly penalized, as would the typist in the Engineering or Research departments where long and technical words are the rule.

Notwithstanding these handicaps in the use of a counter for words, words remain an obviously better unit of measure than lines, square inches, paragraphs, or pages. Pages are probably the easiest way to keep a record without the aid of mechanical counters, but the validity of using such a unit can be seriously questioned.

What appears to be the best unit of measuring success or output in typing is *the number of strokes made.* A stroke may be defined as any single movement in typing. In writing the first capital letter of a new paragraph, four separate strokes must be

made by the typist. These are: (1) carriage return; (2) tabulator key; (3) shift key; and (4) letter key. There is much inequality in these strokes; the returning of the carriage consuming far more time than the other three combined. But when the space at the close of each word is used as the unit of measure, the first three strokes listed are not considered and the last

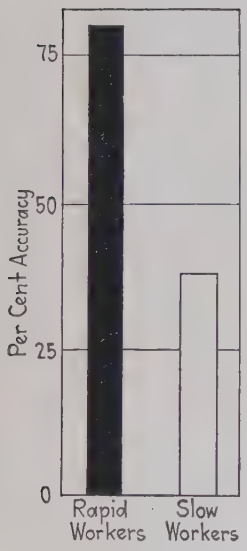


FIG. 80.

FIG. 81.

FIG. 80.—The height of the bars shows how great the difference in accuracy is between fast and slow clerical workers. (*Data from U. S. Civil Service Commission.*)

FIG. 81.—A close approach to the success of press operators can be found from their output and wastage. The half soles cut by this operator and the pounds of leather wasted can be easily determined.

word on the line is usually missing from the record since a good typist will not press the space bar at the end of the line. In spite of their inequality, strokes probably are the best unit of measure to use. Counters can be adapted to record these.

We have used typing as an illustration of how care must be exercised in selecting a unit of measurement. Too much emphasis cannot be given to the principle that, if the final rankings

in success are to be of value, they must have a high validity. The additional time required to secure highest validity is more than offset by the increased utility of the results.

The Quality of Output.—Many firms give a bonus for quality of output, indicating the value in which kind as well as amount of production is held. It is always desirable to have records of both aspects of an employee's success. Output can usually be measured with greater ease and validity than can quality, but this difficulty should not occasion the neglect of quality.

There is a possibility that the worker with the large output has also the best quality. Popular proverbs speak of the slow but sure, the fast and erratic. Whenever the truth of these sayings has been tested by experiment, they have been found to

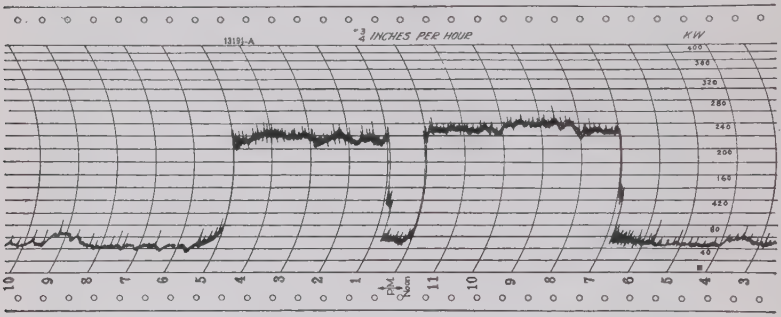


Fig. 82.—This record of electrical load shows a minimum of lost time.

be erroneous. Whether this also holds for industrial workers is yet to be determined. Most psychological workers are inclined toward the belief that it does hold in general for all mankind, in all activities. This belief is more than a "hunch," but it still needs confirming in many tasks for which data are still missing. Until this is definitely settled it is well to have quality records for each worker.[1]

Quality of work can be ascertained from the records of work returned by inspectors—breaking, accident claims in the case of motormen or truckmen, yarn breakages recorded automatically on looms, erasures counted by an efficiency clerk from the carbons of typist's work, back spacing counted automatically on typewriters, claims for defective workmanship, wastage weighed in the case of cutters and blank punchers, and so on. (Fig. 81.)

[1] The author would be glad to work with an employer in studying firm records to obtain more definite knowledge on this topic.

Power Consumption.—When machines are driven by a single electric motor, the power used can be recorded graphically by wattmeters, or total power by watthour meters. Two workers with the same output may be found to be widely separated in firm success by the power consumed in reaching this output. Graphic recording wattmeters have been found valuable in the study of the best methods of work, as well as in revealing individual successes and failures (Figs. 82 to 85).

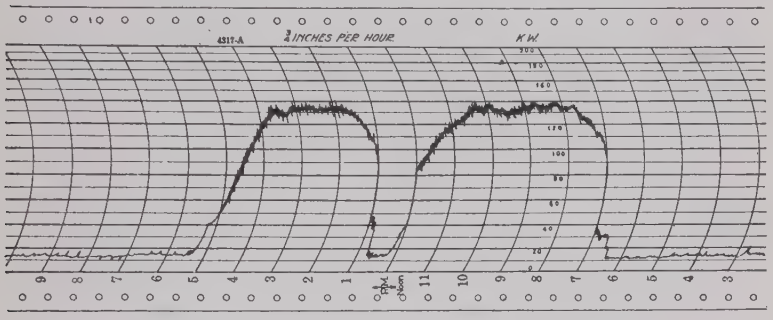


Fig. 83.—This record reveals the employes who are slow on starting and quick on stopping during each working shift. Compare with Fig. 82.

Efficiency as the Measures of Success.—The diagnostic value of the records of individual success is often enhanced if these records are in terms of efficiency. From the point of view of mechanics, efficiency is the output-input ratio. From the present point of view, efficiency is the ratio of actual to possible output. The formula for this would be:

$$\text{Efficiency} = 100 \times \frac{\text{actual output}}{\text{possible output}}.$$

The efficiency of a silk weaver, for example, can be computed by dividing the actual number of picks recorded by the automatic counter in a working day by the number of picks that would have been made by a non-stop loom working the same length of time. In a mechanically perfect loom with perfect yarns and the most skilled operator, there would be no stops except when the thread was used up. Actually, however, these conditions are utopian and are never met with. The maximum possible output in silk weaving under the best actual conditions has been found to be about 85 per cent.

In the case of bobbin winding, the theoretical maximum output was found by Dr. S. Wyatt to be computable only after forty-

eight items were known. The revolutions of the drive shaft were insufficient to give a measure of the highest validity. The question of whether or not this extended analysis was merely scientific meticulousness can only be answered when the data for any particular case have been studied. There is only one safe policy to follow in starting such observations and that is to *go to the extreme of meticulousness and detail.* That is more worth while in the long run since unnecessary elements can be discarded if the results show that they are not to the point, while new elements can be added in most instances only by repeating the entire work. No person engaged in scientific work—and this is essentially scientific work— has gone astray by making the work detailed.

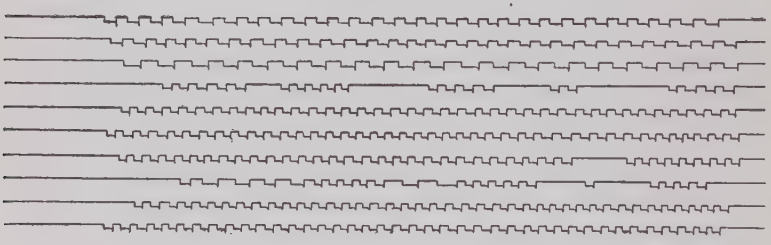


FIG. 84.—A multiple recorder made these records of starts and stops on ten individual machines. It discloses three workers who are either soldiering or having much trouble; in either case poor workers have been discovered.

Wages as a Measure of Output.—Wages have objectivity and reliability, but are they valid? Obviously they are not in many cases where the time-rate system is in use. The wages received in such cases may reflect the length of service, aggressiveness in asking for an increase, size of family, or what not in addition to output or intrinsic success as a worker. When piece rates are followed in payment, the validity of wages as a criterion of success is much higher. Some bonus systems may serve to enhance the measure such as when there is a percentage added for high output, and output of a high quality. This has been observed in a silk mill where the variation in actual output was 11.6 per cent. But the variation in wages was 16.5 per cent, due to two bonuses. Such a system of payment, which involves accurate records of individual output and differences, probably reflects the true value of a worker to the firm better than simple output figures would.

Wages probably are the only direct measure that is available to determine the success of a salesman who is on a commission

basis. Other indirect factors such as goodwill are important but difficult to measure except in increased business from year to year. Gross sales may be a less valid measure of success than profit to the company on the sales. One salesman, for

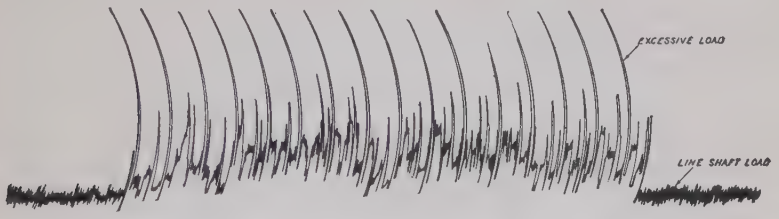


FIG. 85.—Sudden increases in load such as this record shows reveal unsuccessful workers. This is a graphic watt record of a planer motor.

instance, who sells $90,000 of staples in which profits are low is not as successful from the firm's point of view as one who sells only $75,000 of specialties from which the profit is larger and the turnover slower.

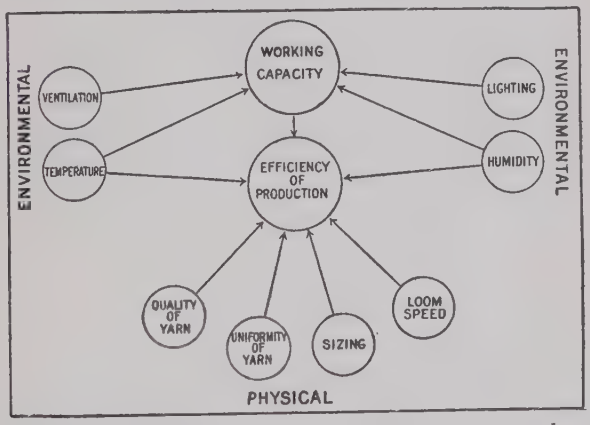


FIG. 86.—Before the apparent success of a cotton weaver can be reduced to actual success it is necessary to take into consideration the factors shown in the above chart. (*Report* 23, *Industrial Fatigue Research Board.*)

There is a small group of employees in which it would seem impossible to obtain any direct measure of success. This group includes secretaries, executives, and design engineers. With the aid of a little constructive thinking, however, it is usually possible to discover some direct and valid measure of the success of most workers.

Personal Factors Should Be Considered.—Regardless of what measure of success is found to be the most useful, the final marking should take into consideration the age and experience of the employee as well as additional personal data that have a bearing upon his productivity. If it is found that those with 10 years of experience in a certain operation have an output 4 per cent greater than those with 5 years' experience, employees in this operation should have their direct measures corrected so that all are on a comparable basis. Similar corrections should be made for the other personal factors that influence production.

Records Must Be Adequate for Comparison.—Emphasis must again be laid upon the fact that a single day's output is

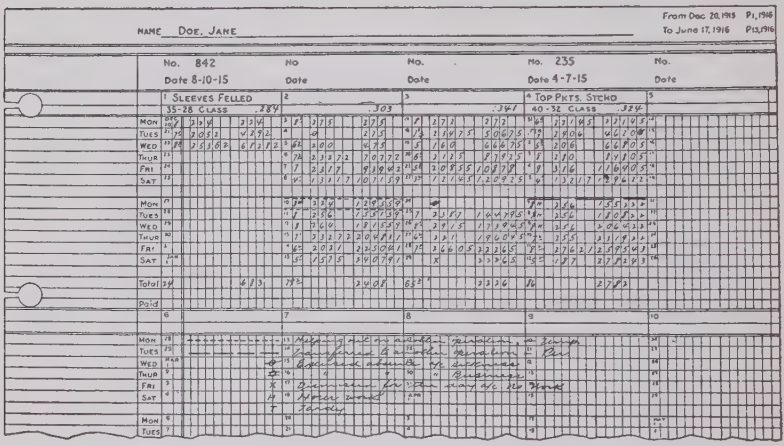


FIG. 87.—Many firms keep close records of each employe's workmanship in special ledgers.

not worth recording unless it is only a part of the output records that are to be kept for a considerable period of time. Allowance should also be made for time lost due to power shut downs which are beyond the workers' control. When these data are recorded quarterly or annually, it should be as the average hourly output with the standard deviation (see pages 229 to 232 of this average also recorded. Before employees are compared later, the standard deviation of their difference in success should be computed to find out if the difference is significant.

Emphasis must be given to the need for securing accurate samples of the grade of work that the persons being studied are doing. If, for example, a visit should be made to an office on

Monday morning and a record kept of the first hour's work of the typists, this record would not be a reliable sample. Sara might have a poor record at this particular time because she was out the night before; June might not be up to par because of temporary ill-health; Esther, on the other hand, might be better at the work than usual because she had remained at home and had rested on Sunday. If, on the other hand, a record were made of the first hour's work for 6 successive days, Sara might get back into condition after the lost sleep had been made up; June's health might improve; and Esther might have been out a few nights to bring her record down. A week's record of this sort would be much more reliable than that of a single day. The records of a month would be much more reliable than those of a single week. As the number of records that are used are increased, the reliability of the sample increases. The worker in employment engineering should not stop short of securing all the records, and as complete records, as he possibly can.

All Workers Can Be Reduced to a Common Basis.—A fair index to the organization of the employees in a department is their uniformity of success. If there is a wide range in their performance on the job, it reflects poor selection of workers more than anything else. The executive can have a visual record of the range of the abilities in all departments if the output—or whatever success measure is used—is reduced to a common denominator. This can be done by taking the average performance in a department as 100 and computing the variation above and below this in terms of percentages. The variation in all departments can then be compared. A serviceable numerical index of the variation in a department is the average variation, computed by averaging all the individual percentage output variations above and below the 100 or average. In this computation all signs, plus and minus, are to be neglected.

This shifting standard of success necessitates some device for interpreting the reports each quarter so that the administration may know whether the reduction in variation among the workers represents an advance in organization or simply the loss of the best and poorest workers. This can be done by recording the actual units output for the present, and the previous quarter that is represented in the variability report by 100. If this does not progress from quarter to quarter, proper control is not being exercised.

WHAT HAS IT COST TO MAKE THE WORKER THE SUCCESS HE IS?

Direct output determinations are usually possible during the period of decreased and poor quality production that accompanies learning. Of course, these should be used whenever possible. From these, depending upon the conditions in each plant, the cost due to increased overhead, accidents, spoiled work, and actual cost of instruction can be determined and these charged up against the worker in his progress records. Comparative yearly reports should be rendered of this cost as a control

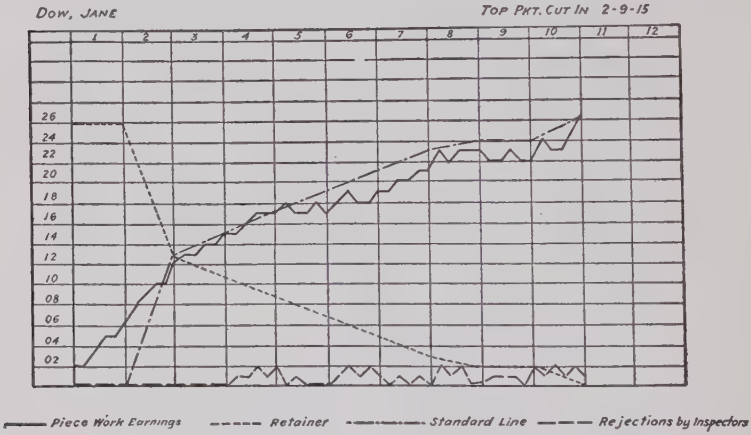


FIG. 88.—A progress and output chart, such as this used by a clothing manufacturer, visualizes records that would otherwise be static.

in the selection of new workers and carefully filed for study by the employment engineers as these records offer valuable guidance to the selection and training of workers.

In some types of work direct output records are difficult to secure. In such cases the most valid records are those obtained by the use of some rating scheme by the foreman, instructor, or experienced workers in a position to judge. But as shown in preceding chapters, as a rule, such judgments are misleading. How to eliminate many of their pitfalls will be next considered.

CHAPTER X

MEASURING PERSONALITY TRAITS

It often happens that the work is such that it is difficult or impossible to have direct measures of productivity and quality. It is also often desirable to have records of the personal qualities of the worker that cannot be measured directly.

The chief concern here is not to tell why there should be such records; their increasing use is an evidence of their need. What must be done is to survey the different ways in which such records are obtained and point out which appears to be the most desirable.

1. Is he cheerful?
2. Does he have a sense of humor?
3. Is he neat and tidy about desk and clothes?
4. Is he honest?
5. Is he dependable?
6. Is he unselfish?
7. Has he self-control?
8. Has he initiative?
9. Is he shy?
10. Is he a good loser?
11. Is he self-confident?
12. Is he conceited?
13. Is he careful with books, pencils, etc.?
14. Is he punctual?
15. Is he truthful?
16. Is he sensitive to criticism?
17. Does he take responsibility for his own acts?
18. Is he obstinate?
19. Does he excuse his own faults and mistakes?
20. Does he abuse privileges?
21. Does he demand more than his share of time and attention?
22. Is he sensitive to beautiful things?
23. Does he stick to a job until it is finished?
24. Does he use his leisure time advantageously?
25. Is he a bluffer?
26. Is he industrious?
27. Is he suppressed?
28. Does he consider the rights and feelings of others?
29. Does he cooperate?
30. Is he courteous?
31. Is he a snob? (Does he consider himself superior to others?)
32. Does he like to tease?
33. Is he rough in his play?
34. Does he lead on the playground?
35. Can he handle people well?
36. Does he take an active part in group activities?
37. Does he take his share in group activities?
38. Is he quarrelsome?
39. Is he interested in what others are doing?
40. Is he popular in his own group?
41. Does he obey school rules?
42. Does he respect authority?
43. Can he organize his ideas effectively?
44. Does he understand explanations and directions quickly?
45. Does he have ability to concentrate?
46. Does he work independently?
47. Does he apply his own experience and thought to the subject at hand?
48. Does he have good habits of work and study?
49. Does he ask intelligent questions?
50. Does he express his ideas well?

FIG. 89.—A *check list* of traits.

A CHECK LIST OF TRAITS

One method is to have a check list, such as is illustrated in Fig. 89. This has the immediate advantage of giving some definite terms with which to work. It overcomes the great dis-

advantages of having to grope for words with which to express oneself. The ordinary foreman, worker, or minor executive has about reached the limit of his command of personality-descriptive terms when he says, "He is a good sort," or, "Guess George is better." A list of traits such as is given overcomes this difficulty.

Six-months period ended _____ Efficiency Rating Form No. 4.

REPORT OF CONDUCT.

1. _____ 2. _____

Name. Department. Bureau.

_____ _____

Common job title. Division. Section. Subsection.

3. Questions to be answered specifically by "Yes" or "No."

a. Does the employee habitually loiter? _____

b. Does he waste time in conversation not related to his work? _____

c. Does he waste time in unnecessary discussion of his work, unnecessary questions, etc.? _____

d. Does he start to put on wraps, etc., prior to closing or lunch hour? _____

e. Does he willingly work overtime when necessary? _____

f. Does he carry out instructions cheerfully and promptly? _____

g. Is he dependable? (Responsible, reliable, steady?) _____

h. Has he any physical defects or ailments which in any way interfere with his working efficiency? _____

i. On the whole, do you consider his department and his attitude toward his work to be satisfactory? _____

4. Use space below to furnish any further information, pertinent to general behavior, habits, personality, or character, which you feel should be made known. In the case of any physical defects or ailments, report nature either below or else orally to your reviewing officer. Use reverse side of this sheet, if necessary, for extension of remarks:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Signed _____ *Date* _____
(Rating officer.)

FIG. 90.—A conduct rating scale used by the U. S. Bureau of Efficiency. It is essentially the same as the check list given in Fig. 89.

In overcoming one serious difficulty, however, it has raised two others to positions of prominence. One of these is that such a way of estimating traits assumes that a person is either cheerful, or he is not. He is either entirely undependable, or he is entirely

dependable. It is obvious that persons are cheerful in varying degrees, dependable in varying degrees, honest in varying degrees. Human traits are not either present or absent, regardless of what the dictionary may lead one to think. Professor Thorndike has said, "Whatever exists, exists in some amount." He had in mind just such situations as these under discussion when this was stated.

What has to be determined in rating such qualities, then, is not whether George is dependable and Alfred is not, but which one is the more dependable; not which one has initiative and which has not, but which one has the more initiative. Thus a person may be honest, but not honest enough for certain types of responsibility. He may be able to express his ideas, but not well enough to explain work to others.

Another serious drawback to using this plan is that it does not properly differentiate between the workers. It is possible for both George and Alfred to be judged dependable, honest, and industrious, so that in the final summing up it takes a toss of a coin to determine which is which.

REPORTING THE AMOUNT OF PERSONAL TRAITS

There are several ways in which the reports may be given in terms of the amount, as well as in the misleading presence or

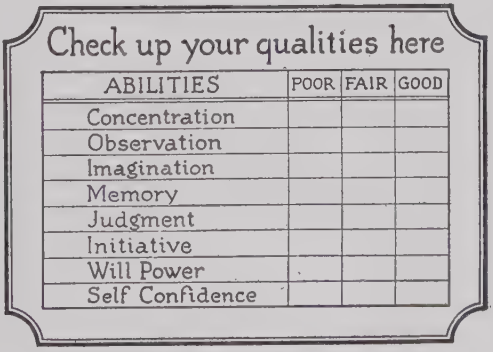


FIG. 91.—A rating scale used by the promoters of a self-help system. This is a further evolution than the two previous scales illustrated.

absence of a trait. One way is by *assigning a score*, ranging from 0 to 100. The person who is reporting indicates by the figure chosen about how much honesty, or dependability, the person being reported on possesses. This has the merit of lending itself to ready mathematical treatment, and it does *appear*

to be highly accurate since George can be scored 87, and Alfred 86. Simply increasing the fineness of the scores, however, does not increase the fineness of the estimates. It gives a false feeling of security. Better than using a scale of 0 to 100 is to use a scale from 1 to 5. Experiment has indicated that it is almost

Quantity of work.	Percentage range.
Very large [1]	126–135+
Large	116–125
Above average	106–115
Standard (average)	[2] 96–105
Below average	86– 95
Small	76– 85
Very small	66– 75
Insufficient	0– 65

[1] It is, of course, important to remember that these terms are relative, so far as the initial ratings are concerned, having reference only to the comparative performance of the restricted group under the supervision of the rating officer.
[2] Average production is represented by 100 per cent.

FIG. 92.—Most of the civil service employes in the District of Columbia are rated semi-annually on this scale, which combines the use of phrases and percentages.

impossible for anyone to estimate these traits with an accuracy greater than is allowed by a scale of from 1 to 5. This coarser scale not only is nearer to the limits of accuracy, but also makes the estimating easier since there are only five scale intervals to consider rather than a hundred.

Quality of work.	Percentage range.
Exceptionally satisfactory; no time required for revision	100
Satisfactory; not more than reasonable time required for revision. (Employees of average ability and diligence will be rated in this range)	99–94
Somewhat inferior; more time required for revision than can be considered justly allowable	93–79
Inferior; time required for revision greatly excessive	78–64
Grossly inferior. (Only exceptional quantity will justify retention of the employee)	63–49
Practically worthless	48 and below.

FIG. 93.—This rating scale used by the U. S. Bureau of Efficiency is an advance over the other forms shown since *descriptive phrases* are used.

One pitfall to be avoided in assigning numerical values to these reports is the result of a common tendency not to report one below 75 or 3. This probably goes back to the papers that were marked in school where a mark of 75 was passing. The

result is that, in most instances, the reports under either system are far too high.

This has been remedied by using the three terms—*high, average, low*—in reporting personal qualities. Or the classes may be increased by the use of five phrases such as *excellent, good, average, fair, poor.*

These are an improvement over the numerical rating schemes. They help do away with the tendency to rate too high, and they do not give a fictitious accuracy to the system such as the difference between 86 and 87 in a trait such as *initiative.*

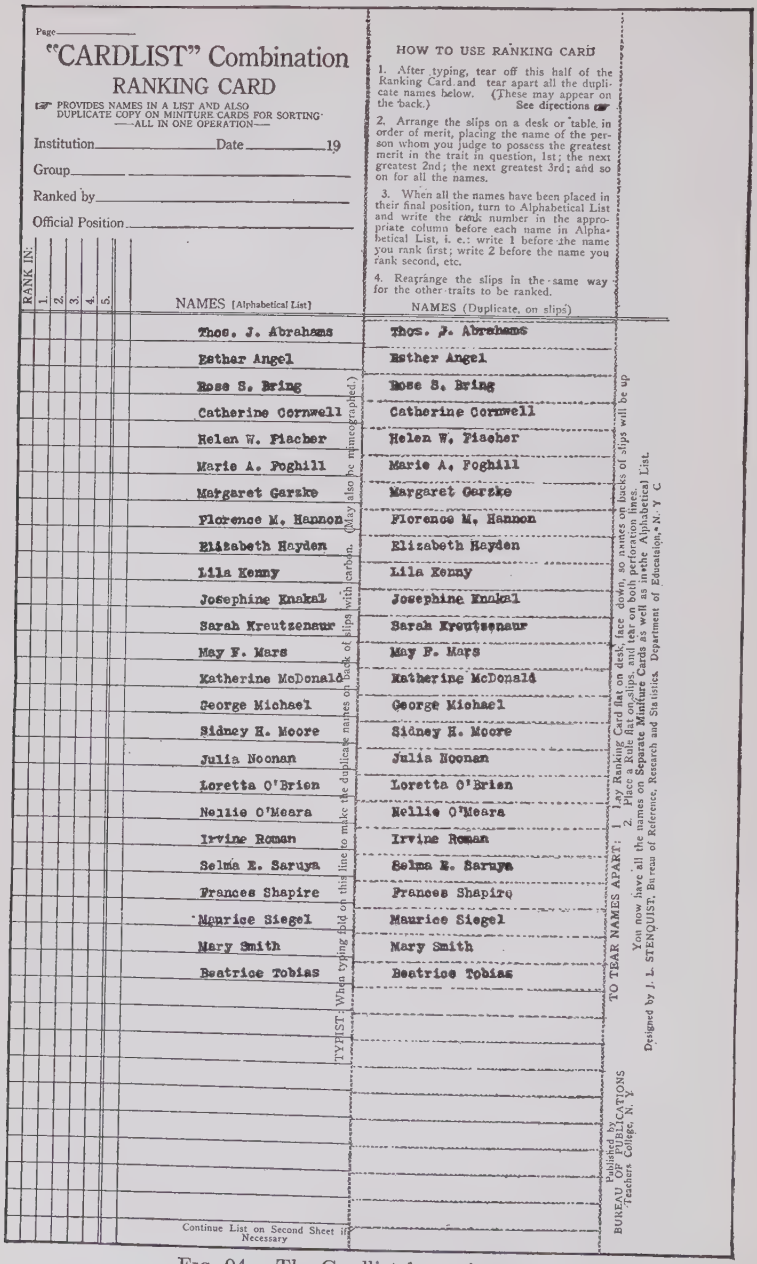
These still leave much to be desired. First, does *excellent* in fact mean the same thing to foreman A that it does to foreman B? A quantitative term has been used, but the chances are that it does not mean the same to all who use it. And then there is the possibility that *loyalty*, and the other qualities reported, do not mean the same things to those reporting. For one executive it may mean doing extra tasks without complaint; to another it may mean giving suggestions for bettering the work; to another it may mean a lack of quarrelsomeness. When these three rate the same workers on *loyalty*, are they rating on the same qualities? The name is the same, but plainly the qualities are not.

These reports should be made in terms of behavior that is fairly definite rather than in terms of abstract qualities. There have been two noteworthy attempts to meet this need. The first is the development of the *man-to-man* rating scale.

REPORTING MEN RATHER THAN WORDS

The simpler form of the man-to-man rating scale is probably the most interesting to use. One form of it is illustrated in Fig. 94. In reporting the personal qualities of his workers with this scheme, the foreman or executive would arrange all of them in the *order of merit.* He would have separate cards prepared, or use cards already in the file system on which the names of the employees were written. If he were rating them on leadership, he would look over these cards and then select the one employee whom he believed excelled the others in leadership. Now note that he does not give this employee a grade of 93. What he does is to place this card on the far edge of his desk.

Then he searches through the remaining cards for the one he considers to be the lowest in leadership. This card is found and placed on the near edge of the desk, opposite the first one chosen.



Page_____

"CARDLIST" Combination

RANKING CARD

☞ PROVIDES NAMES IN A LIST AND ALSO DUPLICATE COPY ON MINITURE CARDS FOR SORTING —ALL IN ONE OPERATION—

Institution_____ Date_____ 19

Group_____

Ranked by_____

Official Position_____

RANK IN: 1. 2. 3. 4. 5.

NAMES [Alphabetical List]

Thos. J. Abrahams
Esther Angel
Rose S. Bring
Catherine Cornwell
Helen W. Fischer
Marie A. Foghill
Margaret Gerzke
Florence M. Hannon
Elizabeth Hayden
Lila Kenny
Josephine Knakal
Sarah Kreutzenaur
May F. Mars
Katherine McDonald
George Michael
Sidney H. Moore
Julia Noonan
Loretta O'Brien
Nellie O'Meara
Irvine Roman
Selma E. Saruya
Frances Shapire
Maurice Siegel
Mary Smith
Beatrice Tobias

TYPIST: When typing fold on this line to make the duplicate names on back of slips with carbon. (May also be mimeographed.)

Continue List on Second Sheet if Necessary

HOW TO USE RANKING CARD

1. After typing, tear off this half of the Ranking Card and tear apart all the duplicate names below. (These may appear on the back.) See directions ☞

2. Arrange the slips on a desk or table in order of merit, placing the name of the person whom you judge to possess the greatest merit in the trait in question, 1st; the next greatest 2nd; the next greatest 3rd; and so on for all the names.

3. When all the names have been placed in their final position, turn to Alphabetical List and write the rank number in the appropriate column before each name in Alphabetical List, i. e.: write 1 before the name you rank first; write 2 before the name you rank second, etc.

4. Rearrange the slips in the same way for the other traits to be ranked.

NAMES (Duplicate, on slips)

Thos. J. Abrahams
Esther Angel
Rose S. Bring
Catherine Cornwell
Helen W. Fischer
Marie A. Foghill
Margaret Gerzke
Florence M. Hannon
Elizabeth Hayden
Lila Kenny
Josephine Knakal
Sarah Kreutzenaur
May F. Mars
Katherine McDonald
George Michael
Sidney H. Moore
Julia Noonan
Loretta O'Brien
Nellie O'Meara
Irvine Roman
Selma E. Saruya
Frances Shapire
Maurice Siegel
Mary Smith
Beatrice Tobias

TO TEAR NAMES APART: 1. Lay Ranking Card flat on desk, face down, so names on backs of slips will be up. 2. Place Ruler flat on slips, and tear on both perforation lines. You now have all the names on Separate Miniature Cards as well as in the Alphabetical List.

Designed by J. L. STENQUIST, Bureau of Reference, Research and Statistics, Department of Education, N. Y. C.

Published by BUREAU OF PUBLICATIONS Teachers College, N. Y. C.

FIG. 94.—The Cardlist for rating employees.

Here is a man-to-man scale. At the far edge of the desk is the high end; at the near edge is the low end. The other cards are arranged between these two extremes as the rater's best judgment prompts him. Those who strike him as having considerable leadership are placed near the far edge, and those with a lesser amount of this quality, nearer the near edge. When all the cards are arranged, there is an order of merit from lowest to highest in leadership as one passes from one card to the next.

This is much more accurate than to have assigned arbitrary numbers or to have used the terms "excellent," etc. If the terms has been used, it is very probable that scarcely a one would have been called poor.

Now that there is an order of merit, however, the men may be given a number for their standing in leadership. Assume that there are twenty cards, representing as many employees. There are several possibilities. One is to give the highest a score of 20, the next a score of 19, and so on down the list. This has the disadvantage, however, of making records from different departments incomparable.

If one department has twenty employees and another department has twenty-nine, a different numerical system would be in use in each.

The best procedure is to divide the employees, regardless of how few or how many there may be, into fifths. Thus, in case there are twenty employees being arranged in this way, the highest four would be given a score of 5, indicating that they were in the highest fifth. The next four would be given a score of 4, indicating that they were in the second highest fifth. Similarly, in case the number of employees reported was thirty, the highest six would be given a score of 5; the next six a score of 4, and so on.

In this fashion a numerical value has been given to each one. The numerical values are not too high since they are determined by the group itself, and nobody is offended by being called "poor." It is only by precautions of this sort that the reports of one executive can be made comparable with those of another.

Some reporting or rating schemes use a modification of this procedure. The scores are reported in fifths of the group but, in place of arranging the card for each worker in the way we have described, the person who is doing the rating simply tries to keep all the workers in mind and checks along a line the place he estimates for each employee as his card appears. The actual

arranging of all the cards in the order of merit is to be preferred for accuracy as well as for the interest value it has for those who are doing the rating.

THE ARMY AND THE WESTINGHOUSE SYSTEMS

Under the direction of Dr. W. D. Scott a man-to-man rating scale was adopted for the rating of all officers under the rank of

RATING BY INTERVIEWER

THIS SIDE NOT TO BE WRITTEN UPON BY APPLICANT

			Remarks
I. Physical qualities—Physique, bearing, neatness, voice, energy, endurance. (Consider how he impresses men in the above respects.)	Highest	20	
	High	16	
	Average	12	
	Low	8	
	Lowest	4	
II. Intelligence—Accuracy, ease in learning, ability to grasp the point quickly, to express himself clearly, and to estimate a new situation.	Highest	20	
	High	16	
	Average	12	
	Low	8	
	Lowest	4	
III. Leadership — Initiative, force, decisiveness, tact, helpfulness, ability to inspire men and to win their loyalty and cooperation.	Highest	20	
	High	16	
	Average	12	
	Low	8	
	Lowest	4	
IV. Personal qualities—Industry, dependability, loyalty, readiness to shoulder responsibility for his own acts, freedom from conceit and selfishness, readiness and ability to cooperate, and charm of personality, breadth of conceptions.	Highest	20	
	High	16	
	Average	12	
	Low	8	
	Lowest	4	
V. General Value to the Company—Special talent (commercial, mechanical, mathematical, executive), gets results, works well in an organization. Special interest in W. E. & M. Co. Previous training and experience. Will develop.	Highest	20	
	High	16	
	Average	12	
	Low	8	
	Lowest	4	

Recommendations of Professors and Instructors—

REPORT OF INTERVIEWER

1 General impressions

2. Work best suited for

3. Acceptance (write Yes or No)

4. Next action promised by interviewer

Signed _____ Date _____
Interviewer

FIG. 95.—A Man-to-Man rating scale used by the Westinghouse Electric and Manufacturing Co. This is used with the "Master Scale" shown in Fig. 96.

Brigadier General in the Army. Essentially the same scale has been employed by the Westinghouse Electric and Manufacturing

Company in the selection of graduate engineers for training in their organization. The scale is shown in Fig. 95.

Each interviewer makes a Master Rating Scale, following these instructions:

I. PHYSICAL QUALITIES. Physique, bearing, neatness, voice, energy, endurance. Consider how he impresses his command in these respects.	Highest Mr. Croy High Wilson Middle Evans Low Adler Lowest Sennett
II. INTELLIGENCE. Accuracy, ease in learning; ability to grasp quickly the point of view of commanding officer, to issue clear and intelligent orders, to estimate a new situation, and to arrive at a sensible decision in a crisis.	Highest Davis High Mc. Croy Middle Hill Low Gowin Lowest Brown
III. LEADERSHIP. Initiative, force, self reliance, decisiveness, tact, ability to inspire men and to command their obedience, loyalty and co-operation.	Highest Evans High Barlow Middle Furbush Low Williams Lowest Myers
IV. PERSONAL QUALITIES. Industry, dependability, loyalty; readiness to shoulder responsibility for his own acts; freedom from conceit and selfishness; readiness and ability to co-operate.	Highest Adler High Wilson Middle Evans Low Myers Lowest Sachs
V. GENERAL VALUE TO THE SERVICE. Professional knowledge, skill and experience; success as administrator and instructor; ability to get results.	Highest Knight High Smith Middle Anderson Low Davis Lowest Persky

FIG. 96.—The "Master Scale."

The rating is made by comparing him in each of these respects with engineers who are now employed in the company. Each rater makes his own scale . . . (Master Scale) . . . Proper rating is largely dependent on the possession of an accurate Master Rating Scale. Do not start to prepare your scale until you can give at least 30 minutes to it.

Write on small paper the names of from twelve to twenty-five engineers who have passed through the educational department within the previous 5 years. They should be men with whom you are well acquainted, and of whose degree of success you have some definite knowledge. Include some whose qualifications are extremely poor as well as those who are highly efficient. If these names do not include all the grades for each of the five qualifications, others may be added.

Look over your names from the viewpoint of physical qualities only. Disregard every other characteristic of each man except the way in which he impresses men by his physique, bearing, neatness voice, charm of appearance and manner, energy, and endurance. Arrange the names on the slips of paper in order from highest to lowest on the basis of the physical qualities of the men. Select that engineer who surpasses all the others in these qualities and enter his name on the line marked Highest under "Physical Qualities" on the Interviewer's Master Scale. Then select the one who most conspicuously lacks these qualities and enter his name on the line marked Lowest. Select the man who seems about half-way between the two previously selected and who represents about the general average in physical qualities and enter his name on the line marked "Middle." Select the engineer who is half-way between middle and highest and enter his name on the line marked "High." Select the engineer who is half-way between middle and lowest and enter his name on the line marked "low."

Thus was constructed a master scale made up of men rather than of numbers or adjectives. In using this type of rating scheme, the person being reported was checked up against the five whose names appeared on the Master Scale. If he seemed to be more like Wilson than McCroy, he was listed in the high division. According to the arbitrary scoring that was used, this gave him 16 points in Physical Qualities.

In the case of the other qualities, the procedure is exactly the same except that Intelligence and the other traits were considered. Of this type of rating scheme in business Dr. Scott says:

> . . . it is relatively cumbersome in use. The construction of the Master Scale and the mental balancing of one man against another call for expenditure of time and effort that the average executive is not in a position to contribute.

Dr. Harold Rugg, who has reported the most critical study of it, found that it was accurate only within one-fifth. That is, a man rated high in leadership on this man-to-man scale might belong either in the highest or in the middle group. In

practical use, this *or any other rating scale* probably does not warrant drawing distinctions between the men in the high and in the middle group. The difference between the highest and the middle group is significant, but the difference between any two adjacent groups is not within the error of the method. But this error is, beyond doubt, much smaller than the corresponding error in a decision regarding intangible factors reached without the aid of such a scale.

THE GRAPHIC RATING SYSTEM

This has been devised to overcome several of the weaknesses of the rating schemes reviewed so far. First of all it is not cumbersome in use. It is reported that "foreman and executives have given hearty cooperation in preparing reports with this scale." In addition, it is a scale of human behavior rather than of vague adjectives. In place of asking that the employees be rated on *cooperativeness* with the degrees of average, high, and low, the graphic scale proceeds as follows:

Consider his ability to work with others:

1. Cooperative.
2. Falls in line.
3. Difficult to handle.
4. Obstructionist.

Other illustrations of an arrangement of this sort of a scale are given in Fig. 97. In a way this reverts to the type of scale with which this survey was started, except that the descriptive phrases are arranged along a line from low to high, whereas the first type of rating scheme previously considered implied either the existence or non-existence of the qualities.

From this scientific point of view, the order of merit system combined with the use of phrases descriptive of human behavior would appear to be the most reliable and valid reporting system to use. There are as yet no data available to answer this question. For the time being, it is probably a wise course to use the system which has many theoretical advantages plus the practical advantage of ease and use. Realizing that any scheme which involves human judgments will always fall far short of the accuracy of a chemical test, this particular form of rating will be surveyed to see in what ways it can be raised to the highest accuracy in practical use.

It would be foolhardy to presume that these schemes diagnose human personality and qualities accurately. Off-hand judgment and estimates of these traits are likely to be completely *inaccurate.*

GRAPHIC RATING SCALE FOR CLERICAL WORKERS.

Name _____ Date _____
Dept. _____ Section _____ Name of Rater _____
Position _____ Position _____

Instructions for making out this report: Before attempting to report on this employee it is necessary to have clearly in mind the definitions of the qualities which are to be reported upon. In each quality judge this employee and place an X somewhere on the line running from right to left that will indicate approximately this employee's standing in that quality. It is not necessary to put the X directly above any of the division points. Judge employee on present job only wherever possible.

QUALITIES	REPORT
I. APPEARANCE. Consider neatness of person and dress.	Appropriate — Neat — Ordinary — Passible — Slovenly
II. ABILITY TO LEARN Consider ease of learning new methods.	Very quick — Catches on easily — Needs repeated instruction
III. ACCURACY. Consider quality of work, freedom from errors.	No errors — Very careful — Few errors — Careless — Many errors
IV. DEPENDABILITY. Consider how well he can be relied on to do his work without supervision.	Very reliable — Trustworthy — Usually reliable — Unreliable
V. SPEED. Consider amount of work accomplished.	Very Rapid — Moderate — Slow. — Very slow
VI. COOPERATIVENESS. Consider his ability to work with others.	Cooperative — Falls in line — Difficult to handle — Obstructive
VII. CONSTRUCTIVE THINKING. Consider his ability to grasp a situation and draw the correct conclusions.	Shows originality — Resourceful — Carries out suggestions — Needs detailed instruction.
VIII. ABILITY TO DIRECT WORK OF OTHERS Consider ability to direct work and gain cooperation.	Gets maximum efficiency — Directs work without friction — Secures limited cooperation — Wastes manpower — Antagonizes

FIG. 97.—A graphic rating scale used by Dr. M. A. Bills with office workers.

Even carefully guided estimates can gain but little more confidence. Yet there exists a genuine need for ratings of these intangible qualities that possess a usable accuracy. Turning now to the ways of increasing both the accuracy and the usable-

ness of these reports, it must be made clear that there are but little data to help decide which form of rating scale has greatest reliability and which greatest validity. This information, experimentally obtained, is greatly needed, but unfortunately it is not available. Until there is experimental evidence at hand, one will have to be content with choosing the apparently best scheme depending largely upon good judgment and the impressions of those who have used the different rating scales.

HOW TO INCREASE THE ACCURACY OF RATINGS

1. Rate All Employees on a Single Trait at a Time.—This reverts to the principles of the card list. In place of rating John Smith on appearance, then on ability to learn, and then rating Richard Roe on the same qualities, accuracy is increased by rating Smith on appearance, then rating Roe on the same trait, and so on through all those being rated. This precaution avoids a shifting standard. Since all are rated on the same trait at the same time, the standard presumably remains much the same.

2. Avoid Direct Quantitative Terms.—The use of such words as *high*, *superior*, and *low*, is undesirable. So is the immediate use of percentages or other numerical scores. They give a false impression of accuracy and fineness but, since they are not defined and in most instances are undefinable, no good can come from their use. A comparison of the scales shown in Figs. 91 and 97 will illustrate this forcefully.

3. If Possible, Rate the Person in Terms of What He Does.—Do not expect to have useful and accurate ratings if the rating merely asks if Smith is high, average, or low in accuracy. If the rater were asked to tell whether Smith made no errors, occasional errors, was careless, or made many errors, the report would be of much more value. Similarly, in place of asking for a rating on such a trait as cooperativeness, ask if he helps others with their work, if he falls in line with new suggestions, if he is individualistic and difficult to handle, or if he is openly antagonistic.

4. Use at Least Three and Not More Than Five of These Descriptive Phrases for Each Trait Being Studied.—At least three are necessary for a serviceable range of discrimination; if there are more than five, the probabilities are that the ratings will appear to have much more accuracy than they really possess

and it will be difficult for the rater to grasp the range of the trait as a unit.

5. Do Not Use Extreme Descriptive Phrases That Will Be Avoided by Those Making the Ratings.—If you are using

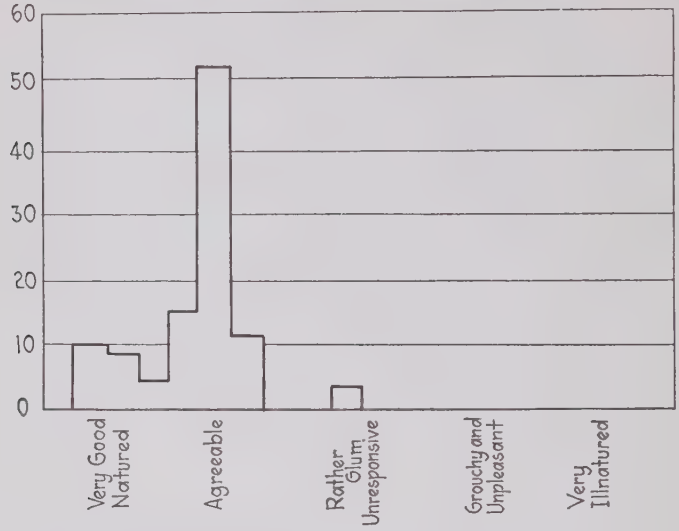


FIG. 98.—The descriptive phrases have not been well chosen since the ratings are all found at the favorable end. Compare with Fig. 99. (*Data from Dr. Max Freyd.*)

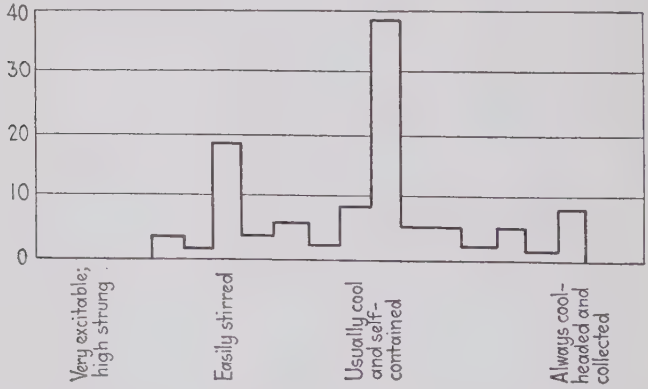


FIG. 99.—This chart of 100 ratings shows a better selection of phrases than in Fig. 98 since there is a normal distribution of the ratings. (*Data from Dr. Max Freyd.*)

five descriptive phrases and are rating one hundred workers, there should be about five of the group rated at the extreme high

end and about five at the extreme low end. If, however, at the high end there is a phrase like "a creative genius," how many will be rated there? Or, if at the low end is a phrase "cannot be trusted with anything," how many will be rated there? It has been found that human traits follow the normal distribution curve and, in constructing scales such as these, they should be so arranged that the descriptive phrases will conform to a normal curve, rather than to expect human beings to conform to biased notions. In Figs. 98 and 99 are presented experimental findings which show how the proper distribution of phrases can be determined.

6. The Raters Should Be Well Acquainted with Those They Are Rating.—A foreman cannot rate John Doe as well as can the man who works at the bench beside him. The supervisor who signs time checks and approves requests for leave cannot rate John Doe as well as can his foreman.

7. The Ratings of Three Separate Persons Should Be Combined to Approach a Just Accuracy.—This does not mean that three raters should work together and produce a single rating, but that three raters, working separately, should have their reports averaged. At least three separate ratings should be combined. Greater numbers probably give greater accuracy.

8. Rate on Important Traits.—There is no use rating on personal appearance when one cannot conceivably see how that trait has anything to do with successful performance on certain jobs. It may be important for a saleman to possess it, but not a mechanic. On the other hand, strength may mean nothing for the success of a salesman while it may for a mechanic. Rating merely for the sake of rating and having a neat set of records on file can hardly justify itself.

9. Determine by Experiment What Are Important Traits.—There is no need to guess at what the significant traits are. There is no need for some preconceived prejudices and moral biases to determine the traits on which employees are rated. The important qualities for success on the present job and on higher jobs can be determined scientifically, as will be shown in the following papers.

10. Have a Scheme That People Like to Use.—If in other ways accuracy is not sacrificed, a scheme that is interesting, easily completed, and one that gains the interested cooperation of those who do the rating is obviously the most desirable.

It is to the advantage of the card list (Fig. 94) that it has a strong interest appeal, perhaps through the mechanical manipulation, perhaps through the "man-to-man" comparison. Those who have used the graphic schemes also report that people like to use them.

11. Have Half of the "Good" Items to the Right, and Half to the Left End of the Scales.—By having the most desirable qualities shift from one end to the other, as the rater proceeds from trait to trait, the tendency to rate high or low is counterbalanced to some extent.

12. Do Not Expect to Average Ratings and Obtain a Numerical Rating That Gives General Value to the Service.—A high rating

FIG. 100.—If the scores of these two men were averaged Gross would have 7.6 and Johnson 7.0, a difference that is not significant. When their profiles are compared, however, a marked difference is apparent. (*Data from Dr. J. E. Downey.*)

in reliability averaged with a low rating in workmanship gives an average general rating, but this does not mean that the workman's value to the service is average. For convenience of reference, an averaged general rating is unexcelled, but for usableness it is highly deceptive. The profile method of representing traits, such as is shown in Fig. 100, is probably the most desirable. When one is in search of a fast worker or an honest worker or one who learns quickly, he can be found on a study of the profiles, but not from a survey of average scores.

13. Correct Ratings Because of the Tendencies of Some Raters to Over- or Underrate.—With traditional employment methods it is probable that all ratings should have a normal distribution. If foreman Jones' ratings do not have a normal distribution, as is shown in Fig. 101, they can be altered by reassigning the proper marks.

14. When Ratings Are Once Obtained, Make Use of Them.—They are of use to the person rated in letting him know his faults and his strong points. They encourage a self-analysis which should be followed up by an attempt at self-improvement. They are of use to superiors in getting them to think about those under them in specific terms. These are incidental uses which might be called the Educational Value of Rating Schemes. Their more tangible uses are found in promotion, demotion, and dismissal. Systematic ratings every 3 months, accompanied by a readjustment of employees in accordance with the ratings, keeps the force at its highest efficiency.

A warning must be given, however, in the use of these ratings. Much injustice may be done by hair-splitting. In the case of

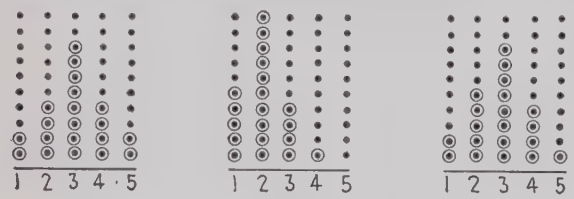


FIG. 101.

Left: The way ratings would be distributed according to the normal distribution curve. Each encircled dot represents one rating of the numerical value shown at the base. The left is the "good" end.

Center: Foreman Cross' ratings are distributed as shown here for the trait of "*dependability.*" He has rated too high. His error is pointed out to him and a re-judging suggested.

Right: He re-judges and his ratings have the distribution shown here.

over 40,000 employees with one concern, ratings are obtained in terms of percentages. A percentage rating of 92 is necessary for tenure in certain positions. If an employee falls to 91, he is demoted. It is apparent that there is not sufficient accuracy in ratings to warrant such a fineness in actual operation. It must, however, be acknowledged, for the present, that there is little difference between 91 and 92. No one should be summarily treated from the results of the rating scales alone. They can serve as a "spotting test" to call to attention outstanding cases, but should be supplemented by other and more trustworthy information.

CHAPTER XI

MEASURING THE RELATION BETWEEN PERSONAL DATA AND FITNESS

How old should an applicant be to be considered for a position as file clerk? For a position as salesman? As labor foreman? How much education is needed to fit the applicant for these positions and for other positions? Is there a possibility of having too much education, just as there is a possibility of an applicant being too old? Should previous experience be demanded in selecting the worker? Should preference be given to married or single men; to married, single, or widowed women?

These questions—and they might be multiplied several fold—are vital ones that recur daily and cannot be ignored. They strike at the heart of employment and their answers are usually determined by policy rather than by scientific method. They have usually been settled in an *ex cathedra* way, the directors or the employment managers talking over these different aspects of the life history of the applicant and then deciding which ones are in the applicant's favor, and which ones are not. The engineering department does not settle questions in such fashion. They make measures; they try out different procedures; they record these data and then reach a decision that bears the earmarks of science. That is largely why the engineering department makes fewer mistakes than the employment department.

It should be apparent from the data thus far reviewed that human judgment of human beings is most unreliable. The factors that make such judgment unreliable also operate in rendering off-hand replies, to the questions already asked in the opening paragraph, almost valueless. The carefully considered reply, the reply that is reached only after long thought, is very likely no better.

A survey was made of traditional employment methods in early chapters. In general, the findings were disillusioning. May it not be that these traditional methods were found unworthy of faith because in a large measure they are directed

toward qualifications the value of which are conjectured rather than known? This strikes at the validity of employment methods. In this and in the following chapter will be briefly told the scientific procedure to be followed in determining what items have validity in predicting the applicant's probable success.

All practical questions regarding the qualifications that will best fit employees for certain pursuits should be answered in the same scientific way in which the engineering department ascertains the relative strengths of different steels. Employment questions can be answered in this way; many of them have been. Employment practice will never be out of the limbo of uncertainty and haphazard procedure until the employment manager is replaced by the employment engineer, in spirit if not in name. How the employment engineer would find the answers to such practical questions as were given in the first paragraph will be shown in this and the following paper.

Assume that there are records, obtained from mechanical counters, of the lines written per hour by twenty-five typists in the New York office of the Egyptian Importing Corporation. One might now glance over the list and see if the better ones are also the older ones. This would be an advance over making a snap judgment, but still it is scarcely an accurate method to employ to answer our question about the relation between age and typing ability.

This could be improved upon by taking the records of the five fastest and the five slowest, finding the average age of each group, and comparing them for any significant differences. By this method, the following might result:

Rapid typists		Slow typists	
Name	Age	Name	Age
Miss J	25	Miss H	18
Miss S	22	Mrs. G	38
Mrs. P	32	Miss F	20
Miss E	24	Miss D	22
Miss O	26	Mrs. S	21

The ages of the rapid typists average twenty-six, the slow ones twenty-four. Is this difference great enough to be significant?

Off-hand, one cannot say. It is not a large difference at most. One of the rapid typists is younger than the average age of the slow ones, while one of the slow ones is older than any in the rapid group. It thus appears discouraging to expect to be able to settle the question in this way.

What is needed is some method whereby each individual can be taken into consideration, and still have the result expressed in simple terms. Mathematicians have found ways that will do this with scientific exactitude. It is not within the scope of this chapter to take up in detail the mathematics of these methods. But the proper procedures to be followed in answering the questions with which this paper started will be taken up in practical illustration.

The records of the twenty-five typists in speed, accuracy, and age are given in the following table:

Name	Lines per hour	Errors per hour	Age
Miss S.	180	6	25
Miss H.	142	8	23
Miss E.	136	7	20
Mrs. M.	191	5	27
Mrs. S.	199	2	29
Miss G.	126	10	19
Miss D.	176	8	22
Miss Ed.	123	11	18
Miss W.	135	9	18
Mrs. H.	118	14	24
Miss T.	129	8	20
Miss Y.	207	4	26
Miss U.	125	11	24
Miss I.	157	9	20
Miss O.	189	6	27
Mrs. E.	140	8	23
Miss A.	124	10	20
Miss F.	114	15	18
Mrs. Y.	168	12	26
Miss J.	125	10	23
Miss K.	150	9	27
Mrs. O.	190	3	28
Miss L.	181	4	25
Miss C.	168	5	24
Miss B.	154	6	24

There seems to be a general agreement between speed and age, but trusting to general impressions in this way gives nothing definite. Increasing the number of cases from ten to twenty-five has apparently done little more than make the task more complicated, and perhaps more hopeless. There is need for some simple mathematical procedure for determining the relation between age and speed at typing. In such a situation use can be made of a *correlation formula* for *the method gains.*

This formula is:

$$R = 1 - \frac{6\Sigma g}{N^2 - 1}.$$

In this formula R is the coefficient of correlation which is to be determined; N is the number of cases used (25 in our problem); g indicates the gain in ranks of one series over the other. This g needs further explanation. In the practical problem there are two series of information about the workers. One deals with their speed at typing; the other with their age. The g element of the formula represents the gain in rank of the items of the one series over the corresponding items in the other series.

The g would be determined as follows: *First,* a second table has to be constructed from the same data. In this table the ages and speeds are arranged by rank. In the preceding table, the highest speed recorded is 207 lines per hour. In the new table, this speed is placed at the top, and accordingly given first rank. The next highest speed is 199, which is given second place. The ages are dealt with similarly, giving 29 first rank, 28 second, and so on. This gives the following rearrangement of the same data:

Rank	Speed	Age
First	207	29
Second	199	28
Third	191	27
Fourth	190	27
Fifth	189	27
Sixth	181	26
Seventh	180	26
Eighth	176	25
Ninth	168	25
Tenth	168	24
Eleventh	157	24
Twelfth	154	24
Thirteenth	150	24
Fourteenth	142	23
Fifteenth	140	23
Sixteenth	136	23
Seventeenth	135	22
Eighteenth	129	20
Nineteenth	126	20
Twentieth	125	20
Twenty-first	125	20
Twenty-second	124	19
Twenty-third	123	18
Twenty-fourth	118	18
Twenty-fifth	114	18

Miss S. (page 198) is twenty-five years of age and has attained a speed of 180 lines per hour. In speed she ranks seventh; in age either eighth or ninth. If the original office records were available, it would probably be possible to tell whether she were eighth or ninth in age by comparing her birthday with that of Miss L. whose age is also given as twenty-five. A compromise will be made by giving both Miss S. and Miss L. an age rank of 8.5.

It is found accordingly that while Miss S. is seventh in speed, she is midway between eight and ninth in age. If speed varied exactly with age, she would have had the same rank in both. But there has been a gain in her rank in speed. This gain, or g, in her case, is the difference between 7 and 8.5, or a gain of 1.5.

In the following table are given for each of the typists their rank in speed and age, and in the third column *the gain of rank in age over the rank in speed.*

RANKS OF THE TWENTY-FIVE TYPISTS, WITH THE GAIN OF AGE RANK OVER RANK IN SPEED

Name	Speed rank	Age rank	Gain of age over speed
Miss S.	7	8.5	
Miss H.	14	15	
Miss E.	16	19.5	
Mrs. M.	3	4	
Mrs. S.	2	1	1
Miss G.	19	22	
Miss D.	8	17	
Miss Ed.	23	24	
Miss W.	17	24	
Mrs. H.	24	11.5	12.5
Miss T.	18	19.5	
Miss Y.	1	6.5	
Miss U.	20.5	11.5	9
Miss I.	11	19.5	
Miss O.	5	4	1
Mrs. E.	15	15	
Miss A.	22	19.5	2.5
Miss F.	25	24	1
Mrs. Y.	9.5	6.5	3
Miss J.	20.5	15	5.5
Miss K.	13	4	9
Mrs. O.	4	2	2
Miss L.	6	8.5	
Miss C.	9.5	11.5	
Miss B.	12	11.5	.5
Sum of the gains (Σg)			47.0

With a few simple computations it will be possible to state, mathematically, the relation between typing speed and age.

$$\Sigma g = 47$$
$$6\Sigma g = 282$$
$$N = 25$$
$$N^2 = 625$$
$$N^2 - 1 = 624$$
$$\frac{6\Sigma g}{N^2 - 1} = \frac{281}{624}, \text{ or } 0.45$$
$$R = 1 - \frac{6\,\Sigma\, g}{N^2 - 1} = 1 - 0.45, + 0.55.$$

Coefficient of correlation (R) between age and speed of typing for the data = $+0.55$.

If there were perfect agreement, the correlation would be +1.0. This would mean that without exception an increase in age was accompanied by a proportionate increase in typing speed. If there were no relation at all, the correlation would be 0.0 indicating only a haphazard or chance relation between these two variables. If the correlation were −1.0, it would indicate that without exception each increase in age was accompanied by a *de*crease in speed of typing. (Apparent exceptions will be noted later.)

The correlation of +0.55 indicates that there is some relationship between age and typing ability, as measured by speed. Is this great enough to justify changing employment regulations so that older workers are employed in preference to younger ones? This can be answered later in a few paragraphs which will take up the significance of these coefficients.

The steps in computing a correlation by the method of gains are:

1. Arrange each series of data by ranks.
2. From this determine the rank of each person in the two series.
3. Determine the gains (g) of the one series of records over the other, *neglecting all the losses*, and using the same series as the base throughout (in our example, the gain of rank in age over rank in speed).
4. Add these gains (Σg).
5. Multiply this sum by 6 ($6\Sigma g$).
6. Count the number of cases (N).
7. Square the number of cases (N^2).
8. Subtract 1 from this ($N^2 - 1$).
9. Divide the figure obtained in step 5 by the figure obtained in step 8 $\left(\frac{6\Sigma g}{N^2 - 1}\right)$
10. Subtract the figure thus obtained from 1. In case the figure obtained in step 9 is less than unity (1), the correlation is positive and should be preceded by a + sign. In case the figure obtained in step 9 is greater than unity, the correlation is negative and should be preceded by a − sign.

FALLACIES OF THIS METHOD

This method of computing correlations is the simplest and quickest. But it has several mathematical errors. First, the formula assumes that all the ranks are separated by equal steps. In the case of the typists, the formula assumes that the difference between ranks 1 and 2 consists of the same number of lines as in the difference between ranks 2 and 3. These two differences happen to be the same, that is, eight lines per hour differ-

ence. But the difference between ranks 3 and 4 is only one line per hour. Yet in this formula it is treated as though it were equal to the difference of eight lines per hour. Obviously, this is a serious weakness.

In general, the method of gains should be used only where the number of cases is small, or as a general preliminary "feeler," since it is one of the easiest formulas to use. In all work in which employment practice is to be determined by a scientific method, the *Pearson* method of correlation, known as the product-moment method, should be followed.

THE PRODUCT-MOMENT METHOD

The *first step* in this method is the preparation of a *correlation table.* The layout of such a table of data for twenty-five typists

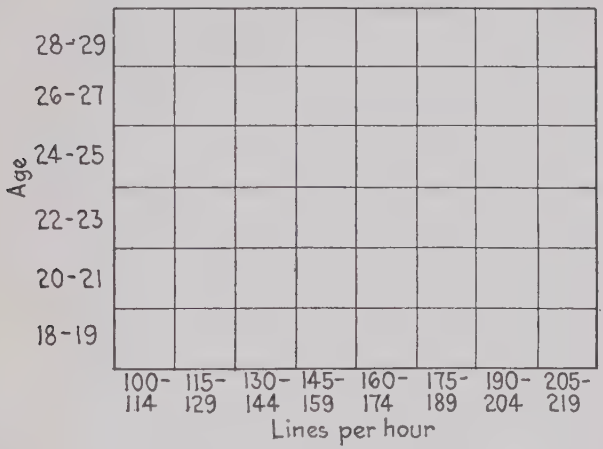


FIG. 102.—The correlation sheet.

is shown in Fig. 102. Along the horizontal axis, there is indicated the speed in typing; along the vertical axis, the ages. The size of the intervals is largely arbitrary. In the present instance intervals of fifteen lines per hour have been used along the horizontal axis since that will give eight intervals. More intervals would increase the labor or computation; fewer intervals, on the other hand, lower the accuracy of the correlation. For most work thirteen or more intervals should be used. In preparing a correlation table one rule should be invariably followed: *along the horizontal axis have the low end of the scale to the left; along the vertical axis have the low end of the scale at the bottom.*

The *second step* is to tally the data on the correlation sheet. Figure 103 illustrates this procedure. Miss S. (page 198) has a speed of 180 and her age is twenty-five. Run the pencil along the horizontal axis of the correlation sheet until the section

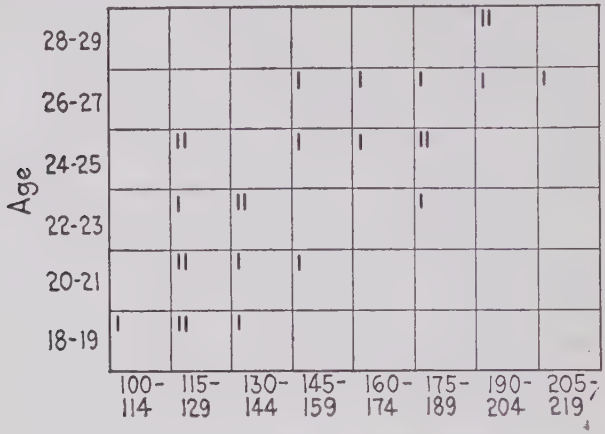


FIG. 103.—The data are tallied on the correlation sheet.

is reached in which a speed of 180 words per minute falls. Then run the pencil down this section until the section crossing it is reached, that indicates an age of twenty-five. In the square made by the crossing of these two divisions, a tally mark is made

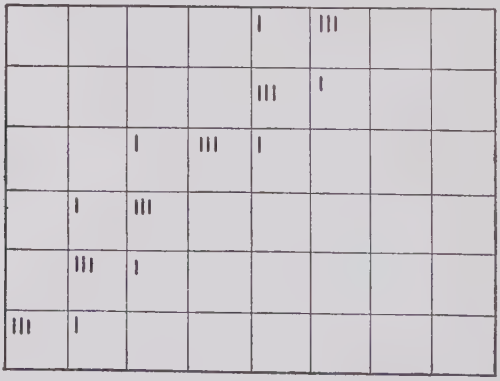


FIG. 104.—An approximately perfect correlation is indicated by this scatter-plot.

for Miss S. Miss H. has a speed of 142 and is twenty-three. Along the horizontal axis the proper section for a speed of 142 is found, and at the square in which it is crossed by the section indicating an age of twenty-three another tally mark is made.

This is continued until the data for the twenty-five typists are tabulated. When it is all tabulated, the correlation sheet has the appearance shown in Fig. 103. This is called the *scatter-plot.*

If the tally marks had fallen in squares, as in Fig. 104, it would be apparent that, with an increase in age, there is an increase in

Fig. 105.—A correlation of approximately −1 is indicated by this scatter-plot.

typing speed. This arrangement would give a positive correlation and one that is practically perfect. This would be a correlation of +1. On the other hand, if the tally marks had fallen in the squares as shown in Fig. 105, exactly the opposite relation-

Fig. 106.—This indicates a correlation of approximately zero.

ship would have been disclosed. Examination of Fig. 105 reveals that with each increase in age there is a corresponding decrease in lines typed per hour. This is a negative correlation between age and typing ability, one that is practically complete and would be expressed as a −1 correlation.

If no consistent variation in speed were found one way or another with a variation in age, as shown in Fig. 106, a zero correlation would be obtained.

The present data, however, are not exactly like either of these. Sighting along the tally marks (Fig. 103), they appear to be somewhere between a perfect positive correlation and a zero correlation, just where between these two points it is difficult to determine. It is the function of the product-moment correlation to find mathematically just how far between zero and perfect correlation the line of the averages of the illustrations would fall.

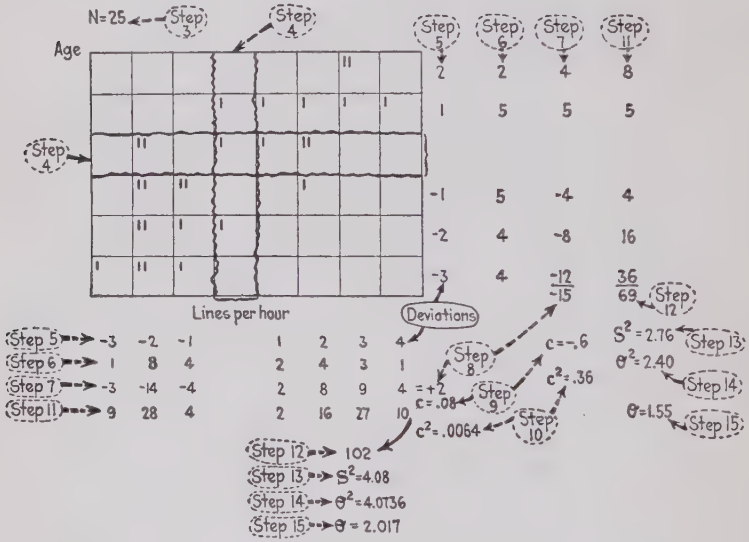


FIG. 107.—The computation of a product-moment correlation.

The succeeding steps in the computation of this relationship are shown in detail in Figs. 107 to 109 inclusive. The first step is the preparation of a correlation sheet, followed by tallying in the data to make the scatter-plot.

The *third step* (Fig. 107) is to record the number of cases, designated as *N*. This value is used several times later in completing the computations. The *fourth step* (Fig. 107) is to estimate the class intervals containing the mid-point, both for age and speed. There are twenty-five cases on the scatter-plot. The interval containing the mid-point for age is found in the horizontal row 24–25, since there are twelve cases below this.

This is inked in heavily. In lines typed per hour, twelve cases are found below the interval of 145–159. The mean accordingly falls in this interval which in turn is marked by heavily inked lines.

The *fifth step* is to indicate the deviation of each interval from the mid-point that has been located for age and for speed. The age interval of twenty-six to twenty-seven is immediately above the one in which we have located the mean, so a deviation of 1 for that interval is indicated at the right end of the correlation sheet. The age interval of twenty-eight to twenty-nine, however, is the second interval above the one in which the mean was found, so its deviation is 2 steps, which is indicated at the right margin.

The interval of twenty-two to twenty-three years is immediately *below* the one containing the mean and, since it is below it is a *minus deviation.* Because it is the first below its deviation is -1, and so recorded at the right margin. Ages twenty to twenty-one are also minus deviations, and in the second step below the mean, or -2. This procedure is repeated along the bottom margin.

The *sixth step* (Fig. 107) is to tabulate the frequency of the items in each horizontal row and in each vertical column. Starting at the top of the correlation sheet and working across, two tally marks are found in this row and this number is recorded in the second column of figures on the margin.

In the next row, five tally marks are found and entered in its proper place. When the bottom of the table is reached, this operation is repeated precisely as in the fifth step. Counting the tallies in the first column, one is found and recorded at the bottom of the column. This is continued until all the rows and columns are tabulated, *except the ones containing the mid-value, which are bracketed.*

The *seventh step* (Fig. 107) is to multiply each frequency by its deviation. The horizontal row at the top has a deviation of 2; the frequency of items in this row is 2. These values are multiplied, giving 4, which is entered on the margin. This procedure is continued for each row and each column, except those containing the mid-value, which are indicated by the brackets. The deviations below the mid-value, in the case of the horizontal rows, or to the left of the mid-value, in the case of the vertical columns, are *negative.* In multiplying, therefore,

the product of these deviations is negative and should be clearly marked by a − sign.

The *eighth step* (Fig. 107) is to add *algebraically* the frequency x deviation, keeping track of the signs and *keeping the column at the right margin separate from the row at the bottom.*

The *ninth step* (Fig. 107) is finding the correction (c). This is found by dividing the algebraic sum obtained in step eight by the number of cases (N) recorded in step three. The signs, whether + or −, must be closely watched as well as the decimals.

The *tenth step* (Fig. 107) is to square the correction (c^2). This can be done with paper and pencil or with the aid of a book of squares. The decimals especially need to be watched in this step.

The *eleventh step* (Fig. 107) is to multiply the values obtained in steps five and seven. In the top row, the value under step 5 is 2, while that under step 7 is 4. These multiplied together give a product of 8 which is entered beside them on the margin. This is continued for each row and for each column, again neglecting the divisions containing the mid-value.

The *twelfth step* (Fig. 107) is to add the values just tabulated on each margin keeping separate, however, the values on the right margin from those on the bottom margin. These values are always positive and signs can be neglected.

The *thirteenth step* necessitates dividing the values obtained in step twelve by N, which gives the square of the standard deviation of each distribution (age, speed) around its assumed mid-value. This is indicated by S^2. On the right margin, S^2 is $6\frac{9}{25}$ or 2.76. On the bottom margin, it is $8\frac{6}{25}$ or 3.44.

The *fourteenth step* is the subtraction of the c^2 obtained in step ten from S^2 which has just been obtained. The difference is known as $sigma^2$. On the right margin the value of c^2 is 0.36; the value of S^2 is 2.76. The difference is 2.40, or $sigma^2$ for the age distribution.

On the bottom margin c^2 is 0.0064, and S^2 is 4.08, the difference of 4.0736 being $sigma^2$ for the speed distribution.

In *the fifteenth step* the $sigmas^2$ just obtained have their square root extracted, giving *sigma.* The sigma for age thus becomes 1.549 and the sigma for speed becomes 2.017.

It now becomes necessary to compute *the product sums of the deviations* for each tally on the scatter-plot that is not in the row or column containing the mid-value. Figure 108 will indicate what is needed. The square numbered 1 is two intervals above

the one containing the mid-value for age, and three intervals below (to the left) of the mid-interval for speed. It deviates 2 in age and −3 in speed. The product of these deviations is −6. Square 2 deviates 2 above the age mean and −2 below the speed mean. The product of its deviation is −4.

Square number 10 is two deviations above the mid-value for age and 4 above the mid-value in speed. The product of these deviations is 8. Since all the squares from 7 to 14, inclusive, are above both mid-points, all the products carry the plus sign. All squares from 15 to 23 are below both mid-values. Both deviations carry a minus sign, so that when multiplied the products have a plus sign. Squares 24 to 35 are above the speed mean and below the age mean. One deviation is thus posi-

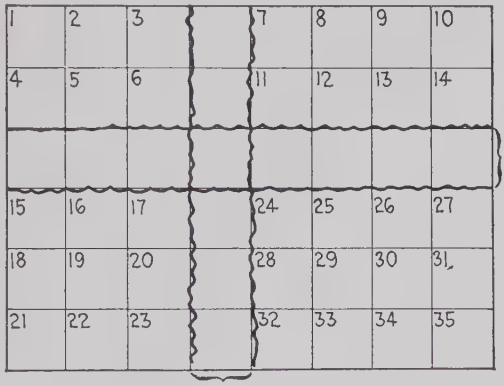


FIG. 108.—See text.

tive and one negative so that when multiplied the product is negative. The products in the upper right-hand and lower left-hand sections of the correlation sheet are positive, while those in the remaining two sections are negative.

Comparing now Figs. 108 and 107, the product of the deviations of square 9 is found to be 6, while there are two tallies in this square. The product of the deviations is multiplied by the number of tallies in each square. In this case the value obtained is 2 by 6, or 12. The square with no tally may be entirely neglected in computing the product-sum of the pairs of deviations; so, also, the tally marks in the row, and in the column estimated to contain the mid-value and marked by the brackets, are to be neglected.

In Fig. 109 are shown the values obtained for the product-sum in each square. The other steps which have been previously indicated on the margin have been omitted in this illustration. The *sixteenth step* is completed by adding these products algebraically. The products with positive signs total 60 while those with a minus value only 2. When these are added we have 58 as the sum of the product deviations.

The *seventeenth step* is to divide the value just obtained by N. This is $^{58}/_{25}$ or 2.32.

The *eighteenth step* is to multiply the two *corrections* obtained in step 9. These are 0.08 and -0.6, which when multiplied give -0.048.

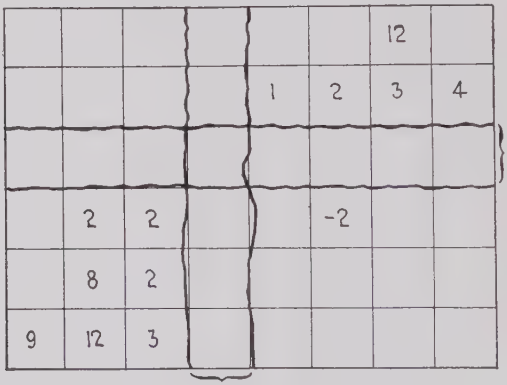


FIG. 109.—Obtaining the product-moments.

The *nineteenth step* is to subtract the value obtained in step 18 from the value obtained in step 17. In the present problem this gives 2.368. The signs must be watched closely in this operation.

The *twentieth step* is to multiply the *sigma* found in step 15 by each other. In our problem this gives $1.549 \times 2.017 = 3.124$.

The *last step* is to divide the value obtained in step 19 by that obtained in step 20. This gives us $2.368 \div 3.124 = 0.78$. This is *the coefficient of correlation*, or r.

Common practice omits the plus sign when a correlation is positive. The minus sign, however, should always be used with the negative correlations.

The correlation obtained by the previous method was designated as R, and was 0.55. The correlations obtained by the *method of rank gains* are always indicated by the capital R, which is always lower than the truer correlation obtained by

the *product-moment method,* which is always indicated by a lower case r. The difference between the correlation of R which was 0.55, and of r which was 0.78, is very large and shows the need of stating which form of correlation was followed.

Whenever the method of rank gains (R) is used, the correlation should be converted into the *approximate* value it would have if it had been computed by the product-moment method by using the following table:

A Correlation Computed by the Method of Rank Gains (R) Has the Approximate Product-moment Value (r) Indicated Below

R	r	R	r	R	r	R	r
0.00	0.00	0.25	0.41	0.50	0.73	0.75	0.93
0.01	0.02	0.26	0.43	0.51	0.74	0.76	0.94
0.02	0.04	0.27	0.44	0.52	0.75	0.77	0.94
0.03	0.05	0.28	0.46	0.53	0.76	0.78	0.95
0.04	0.07	0.29	0.47	0.54	0.77	0.79	0.95
0.05	0.09	0.30	0.49	0.55	0.78	0.80	0.96
0.06	0.11	0.31	0.50	0.56	0.79	0.81	0.96
0.07	0.12	0.32	0.51	0.57	0.80	0.82	0.97
0.08	0.14	0.33	0.53	0.58	0.81	0.84	0.97
0.09	0.16	0.34	0.54	0.59	0.82	0.85	0.97
0.10	0.18	0.35	0.55	0.60	0.83	0.86	0.97
0.11	0.19	0.36	0.57	0.61	0.84	0.87	0.98
0.12	0.21	0.37	0.58	0.62	0.84	0.88	0.98
0.13	0.23	0.38	0.59	0.63	0.85	0.89	0.99
0.14	0.24	0.39	0.61	0.64	0.86	0.90	0.99
0.15	0.26	0.40	0.62	0.65	0.87	0.91	0.99
0.16	0.27	0.41	0.63	0.66	0.88	0.92	0.99
0.17	0.29	0.42	0.64	0.67	0.88	0.93	0.99
0.18	0.31	0.43	0.65	0.68	0.89	0.94	1.00
0.19	0.32	0.44	0.67	0.69	0.90	0.95	1.00
0.20	0.34	0.45	0.68	0.70	0.90	0.96	1.00
0.21	0.35	0.46	0.69	0.71	0.91	0.97	1.00
0.22	0.37	0.47	0.70	0.72	0.92	0.98	1.00
0.23	0.38	0.48	0.71	0.73	0.92	0.99	1.00
0.24	0.40	0.49	0.72	0.74	0.93	1.00	1.00

Unless this one is taken as a uniform basis, great confusion and contradictory or unwarranted conclusions will result.

PRECAUTIONS TO INSURE ACCURACY

A word of caution should be given regarding accuracy in the computations. There is nothing in the calculations that is beyond the ken of a high school graduate. To understand *why* the different steps are taken is another question. It is not necessary to understand the mathematics of the operations in order to obtain accurate results. But to insure accuracy, it is highly desirable to have every operation checked. Experience has shown that the best way to accomplish this checking is to have two clerks work the correlation independently, step by step, comparing their results at the end of each step. This eliminates the misfortune that often occurs when one person tries to check his own work and consistently repeats the same mistake. It is also a time-saving method since an early mistake is corrected before it has invalidated the remaining computations.

WHAT THE CORRELATION COEFFICIENT MEANS

The correlation coefficient tells the degree of casual connection that exists between the two series of data. It makes it possible to predict a person's standing in one trait from his degree of possession of another trait. How close is this connection with a correlation (r) of 0.50? Is it a 50 per cent relation? The correlation coefficient is very misleading in this respect.

In interpreting these coefficients from a practical point of view, what we are most interested in is: How much better than a pure chance coincidence is this relation? It is easily possible for the relation between age and proficiency in the case of a small number of typists to depend almost entirely upon chance alone. If the following formula is used, such questions can be answered directly:

$$\textit{Per cent better than chance coincidence} = 1 - \sqrt{1 - r^2}.$$

A coefficient of 0.0 is, of course, 0 per cent better than chance; a coefficient of 1 is 100 per cent better than chance. But a correlation of 0.50 is not 50 per cent better than chance; it is only 13! A correlation must be as high as 0.86 to be 50 per cent better than chance. The r must be 0.86 before the error of prediction is half-way between a sheer guess and absolute certainty.

Figure 110 gives a chart from which it is possible to read the per cent better than chance relationship without having to use the formula given above. A vertical line (edge of a sheet of

paper) erected above the base line at the correlation to be determined will give the desired value at the point where it crosses the curve.

In general, it can be assumed that there is no correlation or relationship between the factors under study if the coefficient is below 0.20. The relationship is present but it is not great enough to justify many practical inferences in ranges from 0.20 to 0.40. A correlation should be at least 0.70 before much faith is given in the relationship studied, or employees are engaged or dismissed on the basis of the findings. There will be much injustice

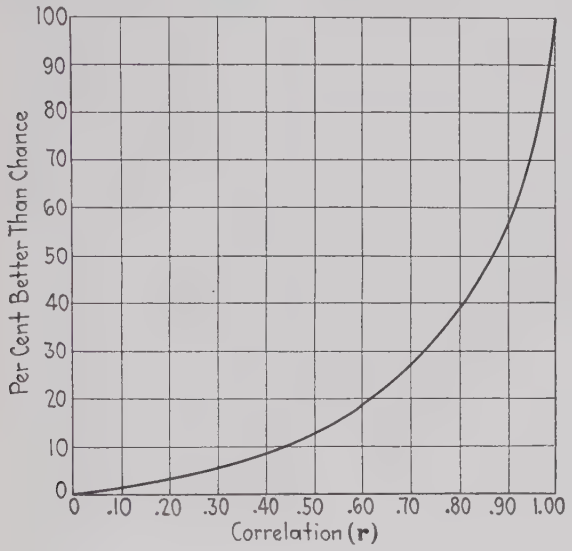


FIG. 110.—See text.

both to the individual and to the firm if standards are set up on a correlation of less than 0.70.

At the same time it should be recognized that a positive correlation is better than no correlation, and that a correlation of 0.20 is better than one of 0.10.

WHEN A HIGH CORRELATION IS MEANINGLESS

The typists disclosed a relation of 0.78 between age and speed. A group of twenty-five was studied. Would the results have been the same if 250 had been studied? Obviously, the findings would have had more universality if there had been several times as many typists to study. But is the number used so small as to render the finding unreliable?

Mathematicians have given the following formula for answering this question:

$$\textit{Probable error of the correlation} = 0.6745\frac{1 - r^2}{\sqrt{N}}.$$

In the problem this gives the probable error of the correlation as 0.05, which is indicated ± 0.05. The findings would be summarized mathematically as follows for the assumed data:

$$r \textit{ between age and speed of typists} = 0.78 \pm 0.05.$$

Interpreting this, it would be fair to say that the assumed data show a moderately high degree of relationship between age and speed of typing. The findings are reliable since the correlation is more than eight times its probable error. It would be fair, if the assumed data were real, to give preference to older typists.

Regardless of how high a correlation, it is unreliable unless it is four times as large as its probable error. If it is less than four times as large as its probable error, it is practically meaningless.

COMMON SENSE AND CORRELATIONS

The exact mathematical value found for the degree of relationship should not supplant reason. The correlation between the speed of a locomotive and its cow-catcher is practically perfect, but it does not indicate that the cow-catcher pulls the train. The coefficients afford a mathematical basis for logic, but do not take the place of it.

An illustration of the failure of both mathematics and logic is contained in the following:[1]

> . . . a certain sales manager for a high-grade specialty concern will not even interview a prospective saleman whose application states that he once sold adding machines. The sales manager had once hired a young man who had formerly sold adding machines. The young man's application had impressed him strongly and the manager thought he had made a "find." But the new salesman failed miserably on the job. His failure closed the company's sales force to all salesmen who had ever sold adding machines, no matter what other qualifications or experience they possessed. Yet common sense should indicate that the particular salesman's previous experience with adding machines may have had no relation whatever to his success or failure. Furthermore, *one* case, *one* instance, does not prove anything.

[1] From the *Service Bulletin of the Bureau of Personnel Research*, Carnegie Institute of Technology, March, 1922.

DOES TYPING SPEED REALLY IMPROVE WITH AGE?

Some data have been assumed for purposes of illustration which show that typing improves with age, there being some exceptions since the correlation was not 1 but 0.78. Even if the data were *bona fide*, this would not necessarily indicate definitely that age was a significant factor determining speed in typing. Are not the older typists likely to be also the more experienced typists? May it not be that age, in the illustration, is merely a rough approximation of experience? If such is the case, and the probabilities are high, the relationship between age and speed is not so high as has been found.

There are several ways in which this can be settled. One would be to compute another correlation for the same typists in which years of experience rather than age was used. Another would be to select a group of typists of the same length of experience. Another would be to compute a different sort of correlation that takes cognizance of the three factors of age, years of experience, and typing speed. This is known as a *partial correlation*. Its computation is very involved and its interpretation difficult. It will be found in any of the more advanced references given at the close of this chapter.

As an example of the use of the first method, the actual data reported by Dr. A. W. Kornhauser[1] which are given in the following, table may be used:

COMPARISON OF INTELLIGENCE SCORES OF MEN OFFICE WORKERS, WITH RATINGS OF THEIR ABILITY BY A SUPERVISOR

Employee	Intelligence score	Ranking in ability by supervisor	Number of months in office
A	67	3	27
B	66	7	8
C	64	9	10
D	62	10	13
E	56	5	12
F	47	8	8
G	45	4	25
H	43	2	25
I	38	1	36
J	37	6	13

[1] *Journal of Personnel Research*, July, 1922.

The correlation between intelligence and ability in the work as rated by the supervisor is 0.41 $\pm$0.17, while the correlation between intelligence and number of months in the department is 0.78. In the case of other clerical workers, a high correlation was found between intelligence score and ability in the work as estimated by the supervisors. This shows that in the case of the data just cited the particular supervisor was judging ability by length of service rather than by actual performance on the job.

WHEN THESE CORRELATIONS FAIL

The illustrations have centered around data that were found on the scatter-plot in an approximately *rectilinear* distribution. In Fig. 111 assumed data have been charted in which the scatter-

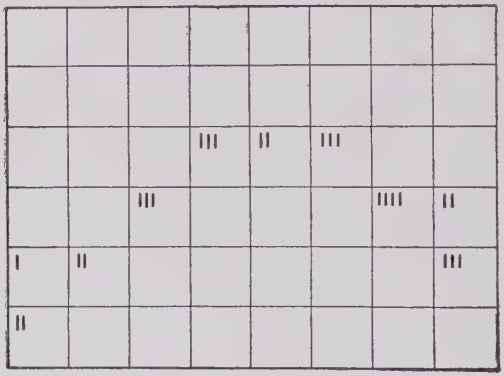


FIG. 111.—A *curvelinear* scatter-plot.

plot is *curvilinear*. The correlation formulas previously given are not applicable to such cases. Thus, in this data, one would probably obtain a product-moment correlation of about 0.20. As a matter of fact, visual inspection of the scatter-plot shows that typing ability does not increase with the number of brothers and sisters as this correlation would lead one to believe. Typing speed, from the assumed data, is closely related with size of family up to a certain point but, above this point, typing ability rapidly decreases.

The practical applications are plain. If the correlation coefficient and its probable error were to be trusted in blindly, it would authorize the selection of typists from large families, when, as a matter of fact, there is a breaking point which is masked in the correlation and which invalidates the practical deductions. For

arrays of data such as shown in Fig. 111, the formula for curvilinear distributions can be used, but, again, the resulting coefficient hides very important facts. This correlation, known as *N* or *eta*, can be found in the more advanced references given. In the following paper, other methods of dealing scientifically with curvilinear data, will be presented and the results of the application of these methods in practical employment situations will be noted.

WHAT CORRELATIONS HAVE SHOWN ABOUT JOB QUALIFICATIONS

Ninety salesmen, selling footwear, were studied by Dr. E. D. Kitson to ascertain any possible relation between their height and weight and their ability as salesmen.[1] It is sometimes thought that size is a factor of advantage in salesmen. Dr. Kitson compared the size of these men with their sales for a year. He found a correlation of 0.11 ± 0.06 between height and sales. This correlation is so small that it indicates no relationship, especially when the probable error (± 0.06) is found to be half as large as the correlation itself.

Between weight and sales the correlation was 0.05 ± 0.06 again indicating no relationship between these two characteristics.

The British Industrial Fatigue Board[2] made similar studies of the relation between the ability of hand composers in two printing establishments and their age and experience. They found the following:

	Plant A	Plant B
Correlation between age and ability..	-0.47 ± 0.11	0.09 ± 0.14
Correlation between years experience and ability.....	-0.30 ± 0.13	0.28 ± 0.13

It is significant that the results at the two plants were not strictly the same, although none of the correlations are especially significant. Contrasted with these factors of age and experience in predicting trade ability is a series of tests developed by the investigators which correlated as follows with ability in the two plants:

[1] *Journal of Personnel Research*, October–November, 1922.

[2] *Report* No. 16, 1922.

	Plant A	Plant B
Correlation between experimental tests and composing ability.....	0.68 ± 0.07	0.74 ± 0.06

The same report gives findings in the case of packers in a candy plant. The correlations in this instance were as follows:

	Plant A	Plant B
Correlation between age and output..	0.38 ± 0.08	−0.29 ± 0.12
Correlation between experience and output.....	0.32 ± 0.08	0.19 ± 0.13

In another report[1] the same board reports a correlation between the number of accidents and age in the case of women engaged in a machine shop. In the case of those engaged in one operation, the correlation was -0.19 ± 0.11, while in another operation it was -0.18 ± 0.10, indicating little relation between age and accidents in this sort of work.

They did find correlations, however, of 0.72 ± 0.07, 0.37 ± 0.12, 0.53 ± 0.09, and 0.69 ± 0.06 between the number of accidents in successive quarters. This indicates that the worker who has a record of accidents will be much more likely to have accidents than will the worker who has had few accidents. The notion that one accident makes a person careful is not borne out by the data. They state, "the worker who has had three trivial accidents is a more dangerous person than one who has had a single bad wound."

In a group of billing machine operators Dr. A. W. Kornhauser found that years of schooling correlated with ability as shown below:[2]

Correlation of years of schooling with:

Speed index	.23[1]
Accuracy index	.31

[1] Probable errors not given.

[1] *Report* No. 4, 1919.

[2] *Journal of Personnel Research*, July, 1923.

Clerical office workers in the employ of the United States government have been the subject of study by Dr. L. J. O'Rourke.[1] He found a correlation of 0.06 between age and efficiency scores and 0.22 between efficiency and experience. The former entrance examination scores correlated 0.33 with later efficiency, while a new psychological examination, which was experimentally devised, correlated 0.65 with efficiency. (Probable errors not given in the reports.)

Office clerks working for an insurance company were found by Dr. L. L. Thurstone[2] to have a correlation of 0.35, between the grade of work done and the age, while the correlation of years of schooling with grade of work was 0.47. The same investigator studied students of telegraphy and found a correlation of 0.00 ± 0.08 between receiving ability, after 100 hours practice, and years of schooling, and a correlation of -0.09 ± 0.08 between age and the same measure of ability.

For readings see list at the end of Chapter XII.

[1] *Journal of Personnel Research*, March, 1923, and *Annual Report of The Chief Examiner and Director of Research*, U. S. Civil Service Commission, 1923.

[2] *Journal of Applied Psychology*, September, 1919.

CHAPTER XII

GROUP COMPARISONS TO FIND CHARACTERISTICS OF FITNESS

How close can employers come to guessing the qualifications that should be looked for in employees?

A few years ago the state normal school at Minot, North Dakota, thought it would solve its teacher-training problems by finding out from school boards just what desirable qualifications teachers should possess. These boards spent a considerable portion of their time in engaging teachers for the public schools. They were experienced, but how closely did they agree upon the essential qualifications? These was scarcely any agreement. Over 700 "desirable qualifications" were considered important enough to mention.

The laugh is not on the school boards, that is, not solely upon them. As chaotic a condition exists with regard to the qualifications for any work. Application blanks give a record of what employers consider the first information to be learned about an applicant's qualifications. The Bureau of Personnel Research of the Carnegie Institute of Technology reported, in 1922, a study of seventy application blanks. In only two items did these blanks agree. One of these was the applicant's name; the other was his marital status. Slightly more than half had an item of age, although age appears to have been significant in predicting success in several lines of work. An application blank should reveal the most significant information about the prospective worker. The significant information about a machinist is practically the same, whether he applies to company X or company Y. But these two companies do not agree at all, so far as their application blanks indicate, regarding the essential items of information to be discovered.

Which is right? Nobody can tell from his armchair and be assuredly confident that he is right.

In the previous chapter one group of methods for determining the qualifications or characteristics associated with success

in any particular line of work was considered. There are other methods of finding out who is right and what should be known before the employer can tell if the applicant will make a successful employee.

COMPARING SUCCESSES AND FAILURES

One of the first methods that suggests itself, to determine the traits associated with success on any job, is to compare the best workers with the poorest workers. Much use has been made of this procedure but unfortunately very few of the results are of any predicative value. This is due to a failure to apply rigorous mathematical principles when evaluating the data. I will show how these comparisons should be made and follow this with a presentation of some of the more valid findings that have been reported. This example is chosen from the field of distribution, but it is rather to illustrate the methods that should be followed than to tell how to pick salesmen.

A firm is selling a specialty by a house-to-house canvass. It has approximately 500 salesmen in the field. There are 344 who have been with the firm over 18 months. These, only, will be dealt with, since there is a possibility that with a little more field work, some of the less experienced salesmen will become successes whereas they now appear to be mediocre, or even failures.

How is it possible to distinguish between the failure and the successes? The men are paid on a commission basis. The salesman with the highest yearly commissions will be considered the most successful; the one with the least commissions will be placed at the opposite extreme. Of course there is a possibility that the first may be in a better territory than the other. If the employer were to have the best judgment on their relative success, however, he would be forced to have them change territory, which is practical in house-to-house salesmanship. Any firm that plans on making a study, similar to the one under discussion, to obtain information that will remove much of the uncertainty in selecting workers could well afford to switch workers in this fashion, provided it would be as practical to do so as it would be in the present instance. The actual production records of 344 salesmen are charted in Fig. 112.

The average salary per year is around $6,000. How shall the successes be separated from the failures? If those with commis-

sions above $6,000 are considered as successes, and those with commissions below this figure as failures, it is plainly unfair. This would amount to separating the distribution curve as shown in Fig. 113. Good salesmen do not leave off and poor salesmen commence so abruptly as this. Or, the underlying factor may

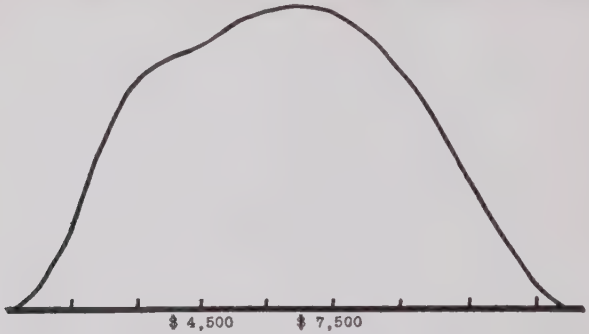


FIG. 112.—The distribution of commissions among 344 salesmen.

be an accident of territory or competition or illness that makes one man fall in the $5,500 class while another is in the $6,500 class.

It would not only be fairer, but it would also give more useful results, if the sales force were divided into three or five sections

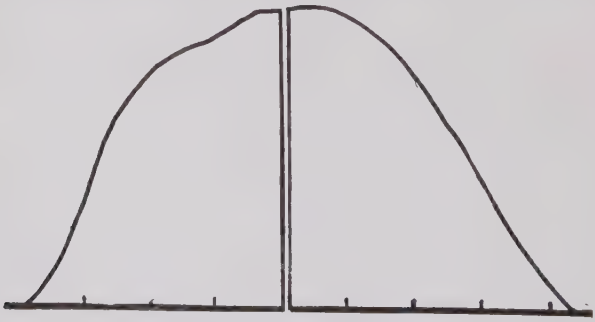


FIG. 113.—See text.

on the basis of sales. They could be divided into three classes as shown in Fig. 114. There are 110 salesmen with commissions of $7,500 or above; 106 with commissions of $4,500 or lower; 128 with commissions between these two extremes. This is as closely as the 344 salesmen can be divided into three equally sized groups.

Now that there are three groups, there are two ways in which to proceed. Whether or not preference should be given to single, married, or widowed men could be determined by finding the number of each marital condition in the highest and in the lowest third. Discard, for a time, the records of the middle 128 on the tenable hypothesis that in many cases it cannot be certain

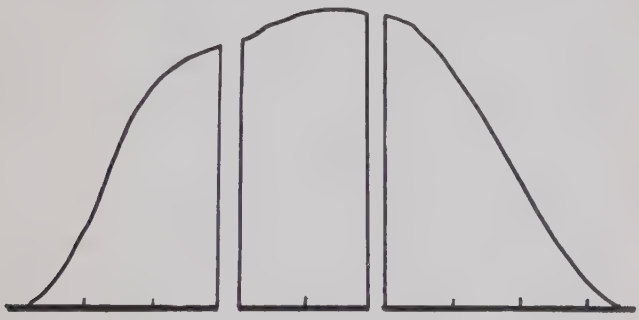


FIG. 114.—See text.

whether the salesmen included in this class belong there or in the higher or lower class of producers. This is always a safe working assumption.

When the good and the poor producers are compared, the data charted in Fig. 115 are found with reference to their marital status. These data were obtained from the *Service Bulletin of*

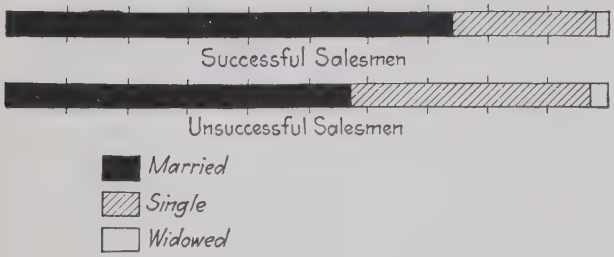


FIG. 115.—A comparison of good and poor salesmen with reference to marital status. The vertical lines mark 10 per cent intervals.

the Bureau of Personnel Research for June 1923. They were not obtained from the group of 344, but are used for illustrative purposes. These data show that more married men are found among the high producers.

So far indications are such that the chances favor the married applicant. This indication can be further tested by using the

middle class, the average salesmen neglected in Fig. 115. In Fig. 116 assumed data for this middle class are represented. These indicate that there is a gradual increase in the percentage of married men towards the group of greater production.

If the number of workers being studied is great enough, it is highly desirable to divide them into five classes in production. The purpose of this is to make the distinction between the middle class of producers and the two extremes more certain. The two divisions that are eliminated remove the salesmen who are in the "class of uncertainty" and thus give added accuracy to the findings.

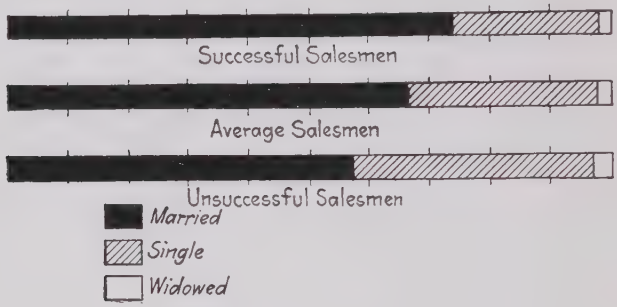


FIG. 116.—See text.

THE INCREASING VALUE OF AGE

In the case of marital status, an applicant is either married or not married. At the same time, some are closer to marriage than others and not all married persons are presumably wedded to an equal degree. One cannot get at these varying degrees. But in the case of age it is plain that there is a sliding scale. If there are three classes rather than two, an age relationship may be found such as is graphed in Fig. 117. If the middle class had been disregarded entirely, the basis for important practical inferences would have been discarded.

If only the poor and the good producers had been compared, creating an employment policy for this work that would have given the preference to men thirty-five years of age would have been justified. But how about those who are twenty-eight? The chart indicates that they are better producers than those twenty-two and one-half. A correlation coefficient would have revealed this tendency; if only two extreme classes had been

used, it would have been covered over. If applicants were being scored on their personal traits, on the basis of these figures the thirty-five-year-old applicant might be given a score of 2 for age, the twenty-eight-year-old applicant a score of 1, and the twenty-three-year-old applicant a score of 0. What score to assign the thirty- or the twenty-five-year-old applicant would have been decided in the light of the correlation coefficient and scatter-plot. (See the previous paper.)

The three-fold separation of the group has this same advantage in all instances where a personal trait is being dealt with that

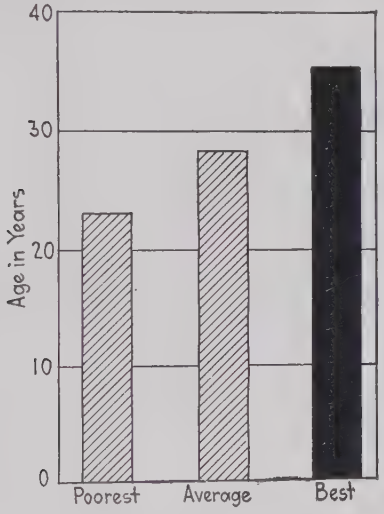


FIG. 117.—A comparison of the average ages of salesmen with different degrees of success.

does not vary sharply from nothing to something as in the case of marriage—owning one's own home, etc. In most personal history items such as age, years of schooling, previous salary, years of experience, number of dependents, and organizations of which an applicant is a member, there is no sudden shift from nothing to something.

IS IT MARITAL CONDITION OR AGE?

In the first illustration it is found, as has been found by many investigators, that there is a greater proportion of married men in the group of better salesmen than there is in the group of poorer salesmen. So many studies have corroborated this that it is now

generally accepted as a policy of wisdom to engage married salesmen in preference to bachelors or widowers. The study is yet to be made, however, that justifies using marital status as a criterion of probable success.

More high producers may be married, but may not marriage in itself be entered into after high production is reached and marriage is made financially possible? May not the number of the married high producers be greater than that of the low producers because the former are also older? Only 11 per cent of the salesmen in thirty-eight firms were found to be big producers before they had reached the age of thirty.[1]

In other words, the two groups of high and low producers are not fairly comparable. What should be done is to select two groups as follows:

Group A.—*The lowest producers with the same age, the same education, and the same years of experience as the following group.*

Group B.—*The highest producers of the same limited age, same education, and same years of experience as the preceding group.*

If groups were carefully selected in this way and *then* compared with respect to their marital status, one would come nearer the truth. The point is that statistics, charts, and tables do not always mean what they appear to indicate. Groups of high and low producers cannot be fairly compared in any one respect unless the other factors involved are kept as nearly constant as possible.

The first step in making such comparisons is to select groups that will be fairly comparable. They should vary, ideally, in only the two aspects being compared, such as production and marital status, production and age, production and lodge membership, or production and education.

Almost all the work reported so far has been invalidated by the failure to observe this first requirement.

A CONTROL GROUP IS NEEDED

It is not enough merely to compare two extreme groups of producers or workers of any kind. This gives valuable information but does not indicate how the successful or the failing group stands *in relation to the general population.* The two groups should not only be compared with each other, but with the general population as well. It is from the general population that

[1] *Service Bulletin of the Bureau of Personnel Research,* January, 1923.

new employees are to be selected, not from groups of successes and failures.

In the case of the marital status of good and poor producers, the data charted in Fig. 116 were reported. There *are* more married men among the successes. But does this mean that married men in the general population make the best prospective salesmen? A *control group* must be used for comparison. In Fig. 118 we have represented such control groups. The control groups are found in the reports of the fourteenth census of the United States and represent all the white males enumerated. To compare with the group of failures, white males have been chosen from twenty-five to twenty-nine years of age; there are over four million in this group. For the control group to com-

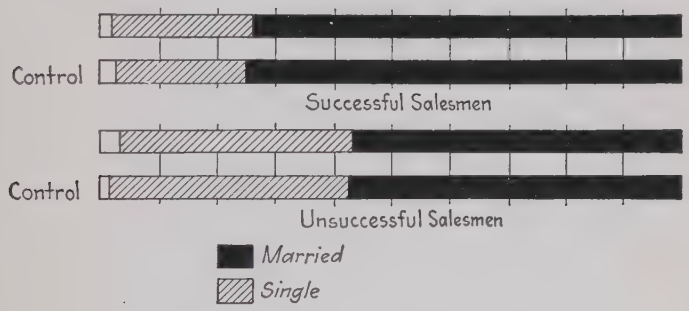


FIG. 118.—See text.

pare with the successes, similar data for almost four million white males from thirty to thirty-four years of age have been used.

When this comparison with a control group is made, it is found that there is no difference between the poor producers and the general population (our control group) in marital status. The good producers, likewise, are no more married than the control group with the same approximate age range. It is almost startling the way the percentages in the control groups agree with those of the two groups of salesmen.

If including men who were older then thirty-four in the control group for the successful salesmen were justified, the percentage of married men in the control group would be larger than 73. This would indicate that more successful salesmen had been selected from single men than from those who were married, exactly reversing many conclusions to the contrary. The point to be emphasized is that an apparently sound inference from a

comparison of the two groups of salesmen dissolves into thin air when a control group is used and the inference may very likely be reversed. *A control group should always be used.*

In the illustration, based upon actual data, the result of proper scientific precaution was to negate a finding. The use of a control group often results in just the reverse. For instance, good salesmen and poor salesmen have been found to be of almost the same height and weight.

Dr. H. D. Kitson found practically no difference between good and poor salesmen in height and weight.[1] The following table gives his findings:

	Average height, inches	Average weight, pounds
Ten best producers:		
Company A	69.3	157.4
Company B	69.0	185.5
Ten lowest producers:		
Company A	70.2	158.7
Company B	69.1	182.6

The heights of the best and the poorest salesmen are represented by the lengths of two of the bars in the left of Fig. 119. The two companies have been averaged. Apparently there is no difference but a comparison with a control group is still to be made. This is indicated by the phantom bar in Fig. 119. It represents the average height of 1,000,000 unselected men from the general population. Their average height was found to be 67.5 inches. Thus, salesmen average about 2 inches taller than men in the general population although there is little difference between good and poor producers. Is this difference large enough to be of any significance? In the following section mathematical ways of determining whether or not a difference is significant will be described. But before we take up this new phase, it may be well to point out that, in the case of height, the control group is perhaps not fairly comparable, since in the main it is com-

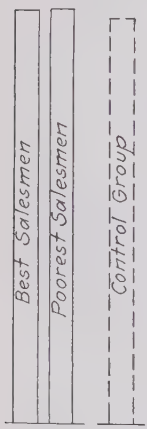


FIG. 119.—A comparison of good and poor salesmen with a control group in height.

[1] *Journal of Personnel Research*, October–November, 1922.

posed of men younger than those included in the sales group. The million men were measured in the army draft. Their ages probably averaged about twenty-five, whereas the salesmen Kitson studied averaged about thirty-seven years.

This demonstrates the need for the control group being a fairly comparable group. In the case of marital status, the groups were fairly comparable. In the case of height, they are not. In weight they are even more uncomparable. The army recruits averaged 141½ pounds; the men Kitson studied, 171½ pounds. Of course this does not mean that salesmen, because they are salesmen, are heavier, but rather does it reflect the fact that thirty-seven year old men are heavier than twenty-five-year old men.

The employment engineer should have sources of control groups ready for immediate reference. When these data are wanted, they may be found in the census reports, in the reports of the examination of drafted men, or they may be obtained from insurance companies.

WHEN A DIFFERENCE IS OF USE

The fact that salesmen are, on the average, 2 inches taller than men in the general population may be significant and again it may not be. In Fig. 119 the difference as charted does not seem

FIG. 120.—The length of this line shows the difference between salesmen and men of the general population in height.

to be very great, perhaps too small to be significant. If the difference is charted as in Fig. 120, it at once appears to be significant. This is because a line has been drawn 2 inches long, to represent the difference. Obviously, the difference is no more significant because it has been charted differently. But it *appears* to be more significant.

Visual inspection in this way does not indicate the true significance of a difference between groups. Charts are very deceptive. One can easily make a difference *seem* great or small, as we have done with the actual data pertaining to the height of salesmen in Fig. 120. The old saw that "figures do not lie but liars figure" could be changed to "charts do not lie but they can be made very deceptive."

The mathematical methods of finding out whether or not a difference is of any significance will now be taken up. It is plain that, while the average height of successful salesmen is 69.6 inches, not all salesmen who are successful are exactly that height or even approximately that height. Some are taller and some shorter, but the average is about that point. The same statement is applicable to the men in the general population. The average height is 67.5 inches but fully half of the men are either taller or shorter than this average figure.

An extreme, and a hypothetical, case for purposes of illustration, will show how an average in itself may at times represent untrue conditions. There are ten salesmen for study divided into high and low producers as follows:

High producers, inches	Low producers, inches
65	67
66	67
73	69
66	67
65	60
Average 67	Average 66

The high producers are an inch taller on the average than the low producers *but* all of the second group, with only one exception, are either as tall as or taller than the average of the first group. One unusually tall high producer and one unusually short low producer have so altered the averages that they give a wrong impression.

It is apparent that, in determining the significance of a difference as expressed by averages, each individual case as well as the averages must be taken into consideration.

I. The *first procedure* in giving each case its due weight is to calculate the *standard deviation of the distribution.* This is usually expressed $S.D._d$, in which $S.D.$ stands for the standard deviation and the sub-d represents the distribution. The formula for determining this is:

$$S.D._d = \sqrt{\frac{\Sigma d^2}{N}}.$$

The d^2 of the formula represents the square of the *deviation* of each measure from the average, N, as usual, represents the number of cases.

For the data of the five high and the five low producers just given, the standard deviation of the distribution as follows would be calculated:

First step. Arrange the data in a single column. This has already been done.

Second step. Compute the arithmetical mean of the series. This is the determination of the average; which has also been done.

Third step. Compute the deviation of each single measure from this average. For the data, this would be as follows, in column d:

High producers			Low producers		
Height, inches	d	d^2	Height, inches	d	d^2
65	2	4	67	1	1
66	1	1	67	1	1
73	6	36	69	3	9
66	1	1	67	1	1
65	2	4	60	6	36
Average 67			Average 66		

Fourth step. Each individual deviation is squared. This is shown immediately above in the column headed d^2.

Fifth step. Following this, total the d^2 (Σd^2). For the high producers this is 46 and for the low producers it is 48.

Sixth step. The totals just obtained in the fifth step are divided by N, the number of cases. In the example, N is the same for both groups. The formula can be used, however, in groups with an unlike number of cases. The present N is 5. For the high producers this is $46 \div 5 = 9.2$; for the low producers it is $48 \div 5 = 9.6$.

Seventh step. The final step is to extract the square root from the values just obtained. For the high producers this is $\sqrt{9.2} = 3.03$; for the low producers it is $\sqrt{9.6} = 3.09$.

These values are the standard deviations of their respective distributions.

II. Next change $S.D._d$ into $S.D._a$, that is, into the standard deviation of the average. The formula for this is:

$$S.D._a = \sqrt{\frac{S.D._d}{N}}.$$

N in each case is 5. The square root of this is 2.23. Dividing the $S.D._d$ found above, gives for the high producers, $3.03 \div 2.23 = 1.36$; for the low producers, $3.09 \div 2.23 = 1.39$. These figures represent the unreliability of their respective averages. In summarizing the data relative to the height of high and low producers, it would be stated as follows:

Average height of high producers.... 67 inches, $S.D._a$ 1.36
Average height of low producers..... 66 inches, $S.D._a$ 1.39

III. Now that the averages and their unreliability are known, it is possible to determine the significance of the difference between the groups. The difference in height is 1 inch. The formula for determining the reliability of this difference is as follows:

$$S.D._{diff} = \sqrt{\frac{S.D._{a_2}^2}{N} + \frac{S.D._{a_1}^2}{N}}.$$

$S.D._{a_2}$ and $S.D._{a_1}$ represent the standard deviations of the two averages. These are 1.36 and 1.39. Squaring these and dividing by N gives:

$$S.D._{diff} = \sqrt{\frac{1.85}{5} + \frac{1.93}{5}}, \text{ or } \sqrt{0.37 + 0.386}$$
$$S.D._{diff} = \sqrt{0.756}$$
$$S.D._{diff} = 0.869$$

The difference in height is 1 inch; the standard deviation or error of this difference is 0.869. Is this difference significant? It is not. *The difference should be at least twice its standard deviation to be significant. It should probably be three times its standard deviation to be useful in affording a basis for selecting employees.*

The standard deviation makes it possible for one to prophesy numerically from the sampling of a few cases what might be found if all possible cases had been recorded. If the difference is twice the standard deviation, the chances are 21 to 1 that the observed difference is the true difference that would have been

found if all salesmen in the country had been studied. When the difference is three times its standard deviation, the chances are 369 to 1.

Whenever two or more groups are compared, the standard deviation of the difference should always be computed. Without it no one can safely "guess" at the significance of the findings. It sometimes happens, however, that the data are such that it is impossible to use this particular procedure in calculating the significance of the findings. Such is the case when the proportion of the successes who are blonds and brunettes are compared.

WHEN PROPORTIONS BECOME OF USE

The difference in proportions of the two groups should also be at least twice and preferably three times as great as the standard deviation or error of this difference. The standard deviation of a difference in proportions is computed after the following formula:

$$S.D._{pro.} = \sqrt{\frac{p_1 q_1}{N_1} + \frac{p_2 q_2}{N_2}}.$$

In this formula, N_1 and N_2 represent the number of cases in the successes and failures, respectively. P_1 indicates the proportion of the successes who are blonds; q_1 the proportion of the successes who are brunettes; p_2 and q_2 have the same indications but for the failures. The formula is solved easily and no further explanation is necessary.

MUCH EXPERIMENTAL WORK OF NO VALUE

It is unfortunate that almost all reports on personal history items are of little value since they either fail to compute these very necessary standard deviations or else fail to mention them in the reports. It would appear that entirely too much dependence has been placed upon hypothetical ability to gain insight from raw averages and distributions. In general, the experimental work on tests for determining potential vocational successes and failure has appeared to be free from these serious and invalidating omissions.

PRACTICAL APPLICATIONS

The purpose of these somewhat time-consuming procedures, of course, is to glean reliable and pertinent information that will tell us the most desirable ages, the most desirable amount of education, and so on, that should be expected of a new employee to assure us that he possesses the qualities associated with success.

It is only by strict scientific methods, such as have been taken up in these last two articles, that the great amount of uncertainty which now shrouds selection can be dissolved.

There was occasion in earlier papers to point out, from an experimental point of view, that the value of letters of application, application blanks, and the personal interview was overestimated in affording a basis for producing results But, of course, letters of application are necessary at times to get in touch with prospective employees. If the desirable personal history items have been determined by experimental means such as have been given, the letter of application becomes a valuable selective agent. If it has been found that age, education, and marital status are the principal personal history items that indicate success, the help-wanted advertisement should request the applicant to state these items. Then, when checked up by the employment engineer, it is possible to tell from an application, with much more certainty than is usually possible with a personal interview, whether or not the prospect is fitted for the work.

Five hundred insurance solicitors were studied by Dorothy B. Goldsmith somewhat after the methods described for the Guardian Life Insurance Company of America. After their production and personal history items had been studied, the following scoring system was found to give the most predicative insight into the probable success of an applicant for this work:

Age	Score	Occupation	Score
18–20	−2	Social	1
21–22	−1	Non-social	−1
23–24	0		
25–27	1	Education	Score
28–29	2	8 years	1
30–40	3	10 years	2
41–50	1	12 years	3
51–60	0	16 years	2
Over 60	−1		
Marital Status	Score	Clubs	Score
Married	1	Belongs	1
Single	−1	Does not belong	−1

Carries insurance	1
Does not carry	−1
Full-time contract	2
Part-time contract	−2
Previous life insurance experience	1
States amount of insurance he is confident of selling monthly	1
Does not reply to this question	−1

The lowest score an applicant can make on this is −9; the highest score is 14. If two men with the following personal histories applied for employment as solicitor, they would be graded as indicated:

Jones:	
Twenty-seven years old	1
Hotel clerk (social)	1
Common school education	1
Married	1
Belongs to B.P.O.E	1
Carries insurance	1
Full-time contract	2
Confident of selling $10,000 monthly	1
Total score	9
Brown:	
Twenty-two years old	−1
Mechanic (non-social)	−1
Common school education	1
Single	−1
Does not belong to a club	−1
Carries insurance	1
Full-time contract	2
Confident of selling $10,000 monthly	1
Total score	1

Jones is plainly the man to employ. But if the men had been engaged through the usual channels of a personal interview, it is possible that Jones might have been refused because of a neatly waxed mustache which the interviewer did not like, or Brown might have been hired because his middle name was the same as the interviewer's. There is but little chance for such minor factors to determine selection when scientific methods are used.

How this particular method works out in actual practice is shown in Fig. 121. If a salesman was successful and his score on the personal history blank 3, a record was made of him in the lower left square. The other squares contain records that represent other solicitors. If a score below 4, on the personal history blank, is used as the critical score, 54 per cent of the subsequent failures are eliminated and only 16 per cent of the successes are eliminated. If this critical score of 4 is used as representing a minimum expected of all applicants, 232 of the lowest producers are eliminated.

The applicant's past is related to his future success. There is more likelihood of there being less falsification in reply to such questions as age, marital status, height, and lodge membership than there is to questions concerning such phases of his past as experience, work done, and salary received. These more objective factors bear a definite positive relationship to his future success. When properly studied the score on the personal history blank is as good if not a better prognosticator of vocational fitness than any of the methods we have reviewed in previous papers.

In the case of different types of work, it is reasonable to expect a different weighing to the items of personal history. In the case of what appears to be the same type of work, there is a probability that different firms will have different weighting and scoring. Thus the demand for employment engineers to have charge of this and other employment work is one of importance for every firm in which hands and heads are as vital in the plant processes as pulleys and presses.

Score on Personal History

Number of successes.....	6	17	18
Number of failures.....	232	159	42
	0	4	8

(*Data from Dr. D. B. Goldsmith*)

Fig. 121.—Insurance salesmen can be selected on the basis of their personal history better than by usual methods when their personal history is scientifically evaluated. If only those with a score of 8 or above on personal history items were selected 391 of the failures would be eliminated.

SUGGESTED READINGS

Kelley, T. L.: "Statistical Method," The Macmillan Company, 390 pp., 1923.

Kelley, T. L.: "Tables: To Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations," *Bulletin of the University of Texas*, 1916.

Yule, G. U.: "An Introduction to the Theory of Statistics," 398 pp., Chas. Griffin & Co., Ltd., 1919.

Rugg, H. O.: "Statistical Methods Applied to Education," 410 pp., Houghton Mifflin Company, 1917.

Tables of squares, cubes, roots and for multiplying and dividing, are very desirable. "Barlow's Tables of Squares, Cubes, Square Roots, Etc." is indispensable for practical work, as is also Crelle's "Tables for Multiplying and Dividing." These are more rapid and less expensive than computing machines.

CHAPTER XIII

THE USE OF PSYCHOLOGICAL TESTS IN SELECTION

To the person unacquainted with psychological tests they are surrounded with more mystery than Chinese food, that is, until one looks over some test or reads about them. When this is done, they appear deceptively simple.

Both of these attitudes are wrong. There is no mystery about mental tests. They are simply an application of scientific methods. It is not divine insight or intuitive powers that make psychological tests; it is nothing more than hard scientific work in devising, checking, and re-checking "conditions that disclose the true character of a person or thing in relation to some particular quality." The psychologist does not sit down and "figure out" his tests. For every item included in a test, in many cases a hundred or more have been tried and discarded. It is finding out, not figuring out, that makes psychological tests.

Thus these test are in fact not so simple as they seem. Although one of the aims in their construction is to have them as simple and uncomplicated as possible, it still remains that in reaching this simplicity a great complexity of method is required. It would appear to be one of the easiest of tasks to go through the pages of juvenile magazines and locate enough puzzles and charades to make several first-class tests. But that is not the way they are made.

This appearance of simplicity has led some employers astray. Four instances are known in which a popular book on psychological tests fell into the hands of employers, won their interest, and stimulated them to devise tests on their own initiative. Three of these after a few months of dabbling with the tests of their own concoction decided they could not make them work, and dropped the projects. The fourth, however, did not let the petty difficulties bother him. He had his test printed, two clerks were employed to tabulate the results, and the tests were actually used for over a year and a half in his employment work. Men were hired or rejected on the basis of their standing in the tests.

A certain mark had been decided upon as a passing or rejecting mark, and it was held to closely.

On what grounds? Simply that this manager had given the matter "close thought" and had hit upon this mark as being a good dividing point. There were no adequate bases for the items in the test, or the use made of the test results. He began to mistrust the result of his efforts after 18 months' use when his output had not shown the anticipated increase following the use of his "psychological test." Then he called in a psychologist of sound scientific training for a week's consultation. After a day and a half it was obvious that the test had been a complete waste

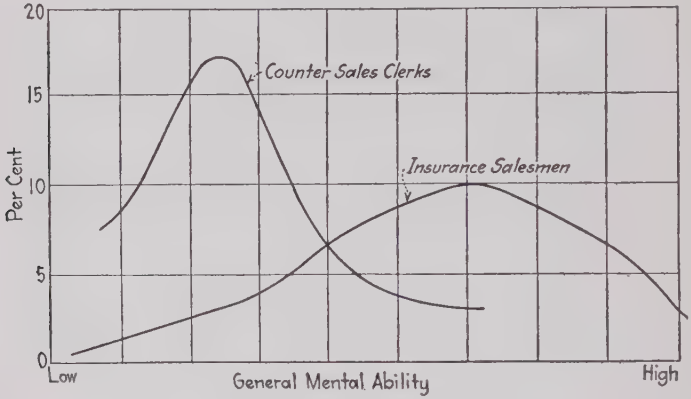


FIG. 122.—Store salespeople are below insurance solicitors in general mental ability. (*Data from Bureau of Personnel Research, Carnegie Institute of Technology.*)

of time and expense. It had appeared simple to devise such a test and use it but the manager found that he had been mistaken.

WHAT A TEST IS

To test is, according to the dictionary, "*to subject to conditions that disclose the true character of a person or thing in relation to some particular quality.*" A test may be of voltage, tensile strength, lung capacity, general intelligence, or trade ability. The fundamental principles back of these should be the same. In actual practice, it is much easier to test voltage than general intelligence, not because the underlying considerations are different but rather because physical phenomena are easier to record and measure than are psychological qualities. The measuring and recording of the one is as much a test as is the other.

Psychological testing then turns out to be just an extension of the testing that is done by every plant. It is an innovation inasmuch as it is a testing of the particular qualities of *persons* rather than of things. And it is an innovation, further, not because it attempts to test human qualities as contrasted with physicial qualities, but because psychological testing increases manifold the accuracy of the usual methods of testing the "particular qualities of persons."

Rough-and-ready psychological testing is done by every administrator almost daily. Whether intentionally or not the habits of work, abilities, and personality traits of his surbordinates are being observed and opinions formed of their true character in relation to some particular quality or qualities. Of course there is not much accuracy to this sort of test. They are tests, however, just as the electrician pinching his fingers across the two terminals is making a test of the line. One significant difference is that the electrician will be able to tell whether the line is "live" or not, while he cannot be certain whether his surbordinates are conscientious or not. There is a great difference in accuracy from the rough-and-ready test of personal qualities to the rough-and-ready test of the presence of electricity. There is even a greater separation between this rough-and-ready test of electricity and possible test in which milliamperes are recorded. Is there a similar range of accuracy from the rough-and-ready psychological test to the modern psychological test that will be described?

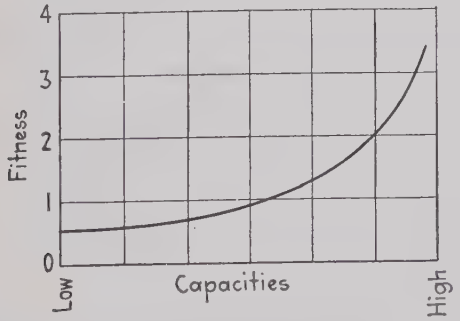


FIG. 123.—Tests and personal data must be weighed. Above a certain point a small increase in capacity may go with a greatly increased fitness.

THE RÔLE OF TESTS IN EMPLOYMENT PSYCHOLOGY

It is easy, and common, to confuse psychological tests with employment psychology. These tests are a part of employment

psychology but by no means are they the sole contribution of psychology to employment, just as educational psychology is not limited to the use of psychological tests.

Thomas Huxley, one of the founders of modern biology, said that "the benefits of science are derived more from the methods than the products thereof." Nothing more true could be said of psychological tests in industry. They have not only provided many tests for use in selecting employees successfully but they have also stimulated the scientific method in selection and have shown the proper way to proceed, whether tests as ordinarily thought of are employed or not.

Tests of things may be chemical or physical. Persons may be tested chemically or physically; industrial physicians are doing this daily. All tests of persons that are not physical or chemical

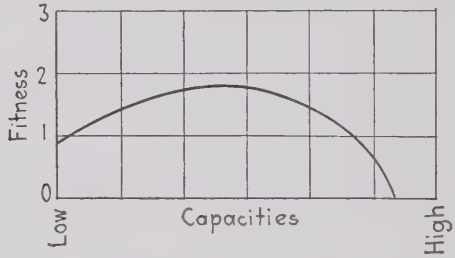


FIG. 124.—Tests and personal data must be weighed. High capacities may be associated with low fitness. (Compare with Fig. 123.)

are properly regarded as psychological, with a few debatable exceptions. It is usual, however, to think of psychological tests as those in which one is given a paper and pencil and instructed in certain things to do while a stop watch is held over him. It is around this popular conception of psychological testing that we will center our discussion for the present moment. It should be borne in mind that in its true meaning psychological testing properly covers all the employment procedures that we have taken up in this series of papers.

WHY PSYCHOLOGICAL TESTS?

Traditional employment methods have been found to be low in reliability and objectivity. Rarely do they approach 10 per cent better than chance in these important qualities. Psychological tests, in contrast, are designed and tested until the objectivity and reliability are well over 70 per cent better than chance.

That is a clear gain, and a gain that can be made only with the aid of psychological tests. Similar gains in validity will be taken up shortly.

A further reason for the use of such tests is that they appear to be fairly direct gages of the capacities and abilities of the applicant while experience, age, education (two preceding chapters) are much more indirect indicators. Instead of "judging," or "estimating," or "guessing," the test provides a method of measuring. There are no reasons for not believing that half of the applicants rejected by traditional methods are better fitted for the work than many who are accepted.

ARE TESTS AN EXPERIMENT?

If tests are in the experimental stage, it is one of the largest experiments ever staged. Almost two million men between the ages of twenty-one and thirty have been successfully tested; children and college students totaling hundreds of thousands have been successfully tested; thousands of employees have been tested and the results put to practical use.

Tests are no more of an experiment than is the measuring of temperature, because old methods are continually being improved or replaced. Tests are no more of an experiment than is the measuring of temperature where thermometers are being used to replace judgments of temperature by color. Tests are not experimental because two different tests give different scores any more than temperature measurements are experimental because Fahrenheit, Baumé, and Centigrade thermometers do not give the same readings.

Tests *are* experimental in this respect: a test that is valid in one plant may not be valid in another plant. The validity must be determined for each plant and this requires experimentation, but no more experimentation than the usual employment methods although tests usually receive the benefit of critical examination while traditional methods do not. This is in favor of the tests.

ARE TESTS EXPENSIVE?

Could your employment department examine 500 men at 9 o'clock in the morning and have them sized up with a reliability of 60, and an objectivity of 90 per cent better than chance by noon? It could not reach those figures for reliability and objec-

tivity if it worked until doomsday. Still psychological tests have been able to do that day in and day out.

Could your employment department report *accurately* upon the intellectual ability, mechanical ability, and clerical ability of 100 applicants for a money cost of $30 for materials and 80 hours of inexpensive clerical work?

Psychological tests are the most economical to maintain. The large item of expense occurs in the first year of their use when the validity of each test is being determined. From then on economy is on the side of the tests.

If someone tried to sell you a machine that would not cut two threads alike (reliability), that could be operated by only one man who was furnished with the machine (objectivity), do you think you would be making a wise decision if you bought that machine when another that did not have these drawbacks and was cheaper in the long run was available? Would you be gullible enough to order a machine to measure electric potential when you had been told beforehand that it not only responded to electric potential but to temperature, air currents, and position of the sun, and that there had been no corrections made for these (validity)?

FIVE WAYS OF TESTING

Every firm employs clerical workers. One can be certain of a community of interest if tests for clerical workers are used as the representative type for the time being. At the outset, it may be stated that tests of the sorts to be described have been worked out and tried for a large range of occupations and trades. Some of these are shown in the illustrations and not discussed in the text.

Trials at the Work.—This is perhaps the most common test that is used. At the same time such a test is often used without one realizing that it is a test. A letter is dictated to the applicant for the position of typist, the lathe applicant is given a turn at the job, or the bricklayer is given a trowel and asked to show his ability. This test may be extended over a trial appointment of a week or more, or it may be limited to a 3-minute performance in the office. Such procedure is obviously little above the level of the rough-and-ready test, but its merits and demerits will be taken up after the other four methods of testing have been described.

GENERAL CLERICAL EXAMINATION.

The following questions, tests, and descriptions of subjects indicate the general character of examination:

SPELLING.—Sentences with misspelled words designed to test the competitor's ability to spell correctly, and to detect misspelled words.

In some of the sentences below one word has been misspelled. Examine each sentence carefully. If you find a word spelled incorrectly, write it *correctly* on the line at the right. If, in any sentence, you find all words correctly spelled, write "correct" on the line at the right.

Samples—Flowrs grow in the country ..... *flowers.*
The man lost his money ..... *correct.*

PENMANSHIP.—The legibility, rapidity, neatness, and general appearance of the competitor's handwriting in the subject of spelling.

CLERICAL TESTS.—1. Write the letter "C" before each statement that is correct, and write the letter "W" before each that is wrong.

Examples—*C* Albany is in New York.
C Milwaukee is in Wisconsin.
W Boston is in Maine.

2. Write the letter "S" before each name in the second list that is *exactly the same* as in the first list, and write the letter "D" before each name in the second list that is *different* in the first list.

First list.		*Second list.*
Abbott and Kelley Co.	*D*	Abbot & Kelley Co.
Roback J. Woody	*S*	Roback J. Woody.

3. Arrange the four cities in Group I below in *alphabetical order*. Write the figure 1 before the city that should come first; 2 before the city that should come next; and so on. When you finish Group I, do the same with the cities in Group II. (The sample is numbered correctly.)

Sample.	*Group I.*	*Group II.*
2 Hanover.	Victoria.	Provost.
3 Hughes.	Williamsport.	Wakema.
4 Jamestown	Kent.	Ravine.
1 Gary.	Wooster.	Thatcher.

4. Underline one of the four words in parenthesis that is exactly opposite in meaning to the word in heavy type. (Samples 1 and 2 are marked correctly.)

Sample 1.—**Master**.....(teacher, cotton, slave, farm).

Sample 2.—**Rough**.....(pointed, shallow, irregular, smooth).

5. Underline the two words in parenthesis that have the same relation as the two words in heavy type. (The samples are marked correctly.)

Sample 1.—**Knife—Cut**...(gun, bird, shoot, run, hat, sharp).

Sample 2.—**Shoe—Foot**..(hat, coat, hand, face, neck, head).

6. Write the letter "C" before each city having a population of over 124,398 and under 199,750. Write the letter "W" before all others. The first three cities have been checked as samples.

City.		*Census 1910.*
C	Oakland	150,174
W	Omaha	124,096
C	Paterson	125,600

7. Number each of the items on the list below according to this code:

Use these numbers—Office equipment..... 1
Traveling expenses..... 2
Office supplies..... 3
Miscellaneous..... 4

3 flat-top desks.. 1 rebuilt Remington.
4 extra janitor service. .... rent for two months.
5 10 gross clips. .... 1 ticket, Chicago to New York.

ARITHMETIC.—The test in this subject consists of a number of practical problems involving the fundamental operations, common and decimal fractions, percentage, and their business application.

Answers.

Twelve clerks filed 960 papers in an hour. What was the average number of papers filed by each clerk?.....

A supply clerk bought three grades of pencils at 35 cents, 40 cents, and 50 cents per dozen, respectively. If his total bill was $37.50, and he bought the same number of each grade, how many pencils did he buy? Express in dozens.....

If the stenographers in a certain office are 15 per cent of the total force and there are 51 other employees, how many employees are there in the office?.....

SAMPLE QUESTION SHEET SENT TO APPLICANTS

FIG. 125.—A miniature occupation test used by the U. S. Civil Service Commission.

Miniature Occupations.—It is often out of the question for an employment office to put applicants through their paces in work requiring the use of bulky machinery. Partly to overcome this practical difficulty, the test known as a miniature occupation was originated. Such a test for clerical workers is shown in Fig. 125. Here is reproduced only the instructions for the test, but sample items are included which illustrate plainly its general nature.

In place of asking the applicant to hunt for a letter in the office files, or to index whatever material happens to be on the

SAMPLE QUESTIONS FOR NEW RAILWAY POSTAL CLERK EXAMINATION.

Mail tests.

These tests are intended to show the competitor's ability to do certain kinds of work required of railway postal clerks, but it is not necessary in answering them for a competitor to have had any previous experience in the Postal Service.

Exercise 1.—Suppose you were sorting outgoing mail. Each square below represents a mail sack for the mail going to the cities named in the square. After each city in the list below the square write the number of the sack carrying mail to that city. In the sample list, "1" is written after "Seattle" because letters for Seattle should be dropped in sack number 1. "3" is written after "Chicago" because letters for Chicago should be dropped in the sack numbered 3. "2" should be written in the blank after "St. Paul" because letters for St. Paul should be dropped in the sack numbered 2. Fill in the blanks after the other cities.

1	2	3
Seattle Portland Spokane	Minneapolis St. Paul Des Moines	Milwaukee Chicago Grand Rapids

City.	*No.*	*City.*	*No.*	*City.*	*No.*
Seattle.....	1	Milwaukee.....	.....	Grand Rapids...	.....
Chicago.....	3	Spokane.....	.....	Portland.....	.....
St. Paul.....	.....	Des Moines.....	.....	Minneapolis.....	.....

FIG. 126.—A miniature occupation test used for railway mail clerks.

desk at the time, he can be given this test which reduces to paper and reproduces in miniature the apparent essential tasks that fall to the clerical worker. Other miniature occupation tests are shown in Figs. 126 and 127.

Essential Capacities.—In following this method of choosing tests for employment study, one analyzes the work that is to be performed in an attempt to ascertain whether the functions demanded are memory, attention, imagination, speed of movement, strength, or intelligence. An analysis of clerical work has been made in this fashion, with the following results:

1. Steady control of muscles needed.
2. Arithmetical ability needed.
3. Ability to sort needed.
4. Capacity to learn needed.
5. Intelligence needed.

The 14 groups of addresses are given you for final decision upon the city to which the mail is to be sent. In each case the mail clerks have sent a list of the cities which they think the sender of the letter may possibly have intended.

In the first, the clerks want you to decide whether the name of the city is "Danvers," "Darwin," or "Hanover." You are sure the State is "Delaware." The first letter of the city must be a "D" because it is just like the "D" in "Delaware." No letter in the city name, however, is like the "w" in "Delaware," and the third letter in the city corresponds closely to the "n" in "John," so the city must be Danvers, and "Danvers" is checked on the list.

1

Mr John Smith
Hanver
Hildware

1. V .....Danvers, Delaware.
.....Darwin, Delaware.
.....Hanover, Delaware.

8

Mrs. John Jones
Bedford,
Delaware

8. .....Bedford, Delaware.
.....Beelford, Delaware.
.....Belfast, Delaware.

2

Mr. Ralph Jones
Jopinfield
Michigan

2. .....Jopinfield, Michigan.
.....Johnsfield, Michigan.
.....Topsfield, Michigan.

7

Miss Effie Otis
Ashley
Alabama

9. .....Ashley, Alabama.
.....Ashby, Alabama.
.....Ash Cy., Alabama.
.....Oakley, Alabama.

FIG. 127.—Postal clerks often have to read the unreadable. This is a miniature occupation test for this ability.

After this analysis, tests were collected to measure the applicant's status in each of these apparently essential capacities. The tests used were:

1. A metal rod to be passed down a channel between two brass bars. The channel narrows at one end and each contact of the rod with the sides of the channel is registered electrically.

2. Tests of addition, multiplication, and division.

3. Cards with different characters on them to be sorted into piles according to the character on the cards.

4. A page of letters to be "translated" into other symbols according to key list.

5. Two short tests of intelligence.

Unless appearances are deceiving, this test for clerical ability is not testing quite the same abilities as did the miniature occupation test. Appearences *are* sometimes deceptive. Whether or not it is so in this case cannot be told until the two test series are compared mathematically after they have been taken by a group of clerical workers.

Occupation.	Intelligence.	Accuracy.	Patience.	Strength.	Color sense.	Endurance.	Keenness of sight.	Dexterity.	Artistic feeling.
Compositor	*	*	*		*			*	*
Linotype operator	*	*	*			*		*	
Monotype operator	*	*	*			*		*	
Monotype caster	*	*	*			*		*	
Stoneman	*	*	*	*	*		*	*	*
Proof reader	*	*	*			*	*		
Press feeder		*				*			
Pressman	*	*	*		*		*		*

FIG. 128.—An analysis of the essential capacities for different printing occupations.

The Empirical Method.—Tests may be miniatures of the work—tests of what appear to be the essential capacities—or random tests that have been employed until those are found which show closest relation to later skill in the work. This last method is the empirical method of testing. If this method were to be followed a large number of clerical workers would be given an assortment of a dozen or more tests, chosen largely at random and from their reliability rather than for any external resemblance that they might have to the work of a clerk.

After such a group of miscellaneous tests has been given, the scores on each test are compared with clerical success. If most of the good clerks make high scores on one test while the poor clerks make low scores on it, it would indicate that the test measures the clerical abilities of the workers, regardless of how far removed from their work the test may appear to be. The scientific methods decribed in the two preceding chapters may result in two-thirds of the random tests being discarded because no relationship was found between their scores and their clerical abilities. The tests that are retained, however, are valid tests of clerical ability and can be used with mathematical accuracy.

The underlying assumption is that they measure some factors closely related to fitness, and not fitness itself. For instance X may be the inherent, inborn, basic qualities of the applicant that are involved in the work to be considered. This factor X may manifest itself directly as characteristics a, b, c, and d. Now a, b, c, and d may be measured. This is what is attempted in the method of essential capacities. Or x may make itself known through m, n, o, and p although there is no obvious connection between these characteristics and the immediate work.

TRADE TEST

STRUCTURAL STEEL WORKER.—
Iron Worker, Erector

ORAL

COMMITTEE ON CLASSIFICATION OF PERSONNEL IN THE ARMY

Trade Test Division

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QUESTION 1

Q. What is a dolly bar used for?
A. Bucking up rivets. Score 4

QUESTION 2

Q. Why is a snap used in a riveting hammer?
A. To form the head on the rivet. Score 4

QUESTION 3

Q. What should be done if there are bad holes in steel?
A. Ream them. Score 4

QUESTION 4

Q. What do you call putting lines through blocks?
A. Reaving. Score 4

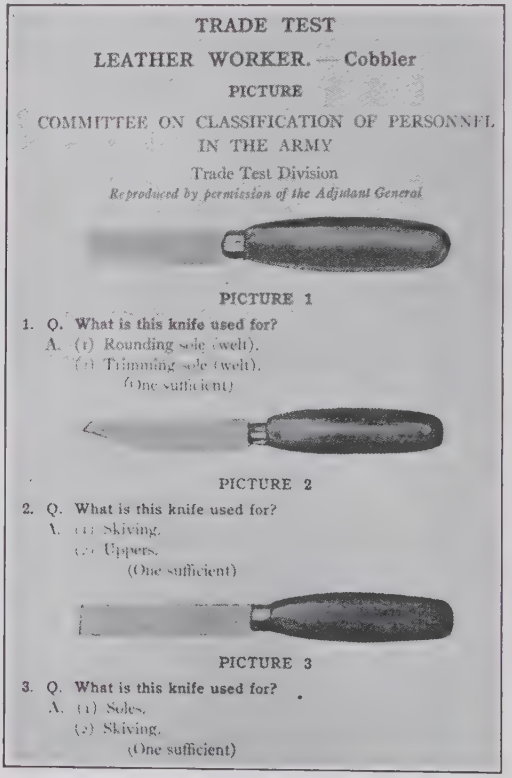
FIG. 129.—An oral trade test.

But since they are the effects of the same cause as a, b, c, and d when m, n, o, and p are measured, as fair a measure of fitness exists as though the first group had been tested. The empirical method is a trial and error procedure that must be continued until these somewhat remote correlations of fitness have been found.

Trade Tests.—The four methods presented so far test largely the actual ability on the job or apparent capacity for the work. The method of trade tests measures how much the applicant

knows about the work. If a man applies for work as a truck repairman, he can be asked, not where he worked or how long he has worked, but such questions as:

"What clearance should be allowed between the ends of rings in fitting new pistons?"



TRADE TEST

LEATHER WORKER.—Cobbler

PICTURE

COMMITTEE ON CLASSIFICATION OF PERSONNEL IN THE ARMY

Trade Test Division

Reproduced by permission of the Adjutant General

PICTURE 1

1. Q. What is this knife used for?
   A. (1) Rounding sole (welt).
   (2) Trimming sole (welt).
   (One sufficient)

PICTURE 2

2. Q. What is this knife used for?
   A. (1) Skiving.
   (2) Uppers.
   (One sufficient)

PICTURE 3

3. Q. What is this knife used for?
   A. (1) Soles.
   (2) Skiving.
   (One sufficient)

FIG. 130.—An oral trade test supplemented by photographs.

"How should carbon be removed from cylinder and piston heads?"

"What are indications of wear in a ball bearing?"

An applicant who knows his trade as an expert will be able to answer all such questions relevant to his trade, and the one with makeshift knowledge will be detected by his incorrect replies.

FIG. 131.—A performance trade test for linemen.

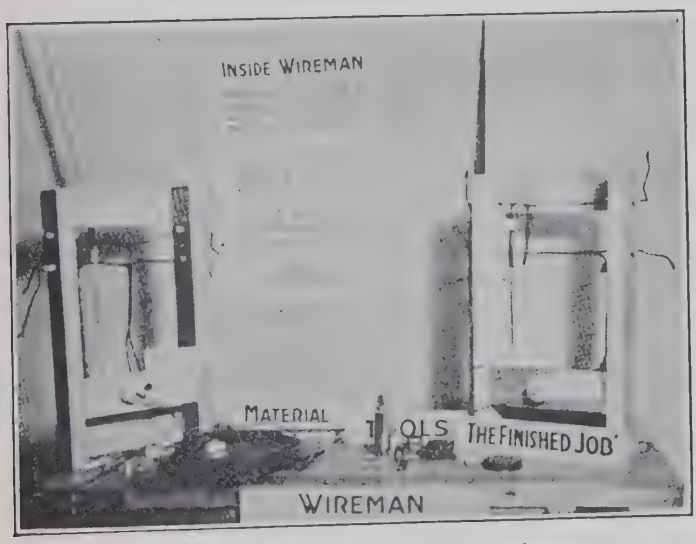


FIG. 132.—A performance trade test for wiremen.

RELATIVE MERITS OF THESE METHODS

The use of actual trials at the work is obviously limited. First of all they can be applied only to workers claiming experience, a demerit it shares with the trade test and to some extent with the miniature and essential capacities methods. These are tests of *abilities* to do rather than test of capacities to do. In other cases, experience may modify their performance. There is need for both, but in many respects knowledge of the applicant's capacities for the work in question is the more important, especially in selecting young workers. Tests of abilities to do will always be handicapped by the fact that the operation is not always done the same way in every plant. An applicant for work as a leather worker may fail to pass one of these two tests because the plant in which he has learned his trade employs archaic, patented, or unusual methods that are different from those in vogue in the plant to which he is applying. Such a case is far from imaginary and, in spite of his failure to make a good showing in the actual abilities on the job, he may have very desirable capacities to do the work which that type of test did not disclose.

Of course the final test of an applicant's fitness is his actual performance on the job, but a test that demands previous experience on the part of those taking it will not be useful in a large number of cases.

The final test of the usefulness of a test is the way it predicts subsequent success or failure on the job. The relative merits of the different methods of using tests in employment in this all-important respect cannot be settled from the armchair, or for all tests. Some miniature occupation tests are better than some empirical tests at spotting potential successes; some miniature occupation tests are poorer. One cannot fairly sum up the available evidence and say that the one is better or worse than the other.

It is the final test of the test that should determine the method to be followed. To all outward appearances, the miniature occupation method may *seem* to test the ability or capacity in question, but no one can tell with any certainty until the test results are compared with actual performances on the job a month, a year, or two years later.

Just because some learned professor has analyzed the abilities involved in some work as consisting of memory and steadiness,

and has devised tests for memory and steadiness, it does not follow that the applicant's fitness for the work is being probed and measured. Just because the applicant has been given a turn at a lathe or has set a "stick" of type, it does not necessarily follow that he has demonstrated his abilities and capacities at the work. It may *seem* that he has. But analyses, arguments, and analogies are all beside the point if there are no data mathematically studied to measure the exactness with which the different tests actually select the best workers.

A case in point is the use of reaction time tests by one of the allied armies for the selection of aviators during the World War. In this test, the time it takes the person under observation to start a definite movement after the signal has been given is measured in thousandths of a second. The fast reacters were given training in flying; the slow ones were shunted into other war activities.

With what justification? No empirical evidence was collected to find out if good flyers were really the fast reacters.

In America, on the other hand, the procedure was different. Reaction times were tested, along with several other functions, and later compared with actual flying performance to find out which tests were most closely related to flying capacity. When this was done, it was discovered that three different reaction time tests showed practically no relation to flying!

There is a large vocational guidance institute sponsored by a continental university that uses reaction time tests almost exclusively, since some persons gathered around a table, talked things over, and decided that such a test would be useful in finding out what sort of work the young people of that country were fitted for. What are the chances that they were right in this decision? Not more than two or three in a hundred!

This is not a pessimistic attitude. It is simply that it is a mistake to let professional enthusiasms run away with scientific training when it comes to evaluating tests in business. At the same time practical experience with tests has led to the firm conviction that when properly understood and used they mark a great advance for any plant.

All employment procedure is a testing. It is an attempt to determine the true character of the applicants with reference to some particular quality. When the employment procedures are scientifically determined and evaluated, they are called

psychological tests since the method of psychological testing has been followed rather than the usual rough-and-ready method.

Ordinary employment selection is time consuming. The chances are scarcely more than four or five out of a hundred that the best applicant has been selected, or that the applicant has been placed in the position where he can use his best capacities.

When selection has been developed by scientific methods, one-half the usual time is consumed; the accuracy of placement is quadrupled; and an unvarying standard is maintained from day to day. The use of tests in the ways that have been outlined will bring this about. But just because a "test" is used does not mean that this change has been effected. Tests may be compared to theater tickets or poker hands; an individual gets a good one, and sometimes he does not! How to tell whether one has a good one or not will be our concern in the following chapter.

CHAPTER XIV

THE CONSTRUCTION AND EVALUATION OF TESTS

Only a score of years ago psychological tests were unknown. There were psychological laboratories but most of their experimental work had been related only indirectly to tests of any practical use. Now there are several hundred tests that have been put to almost every conceivable use. As has been hinted in the preceding paper, this has not been mushroom growth but rather a cautious, scientific development of instruments for measuring the capacities and abilities of individuals. The first task before us is to try to put some order into this chaos of tests so that their underlying similarities will be evident.

The first tests to gain widespread attention were of such a nature that only one person could be tested at a time by a tester, or examiner. These were *individual tests.* If a test required an hour, as most of them did, only eight individuals could be examined in a day. For a decade the individual test held the center of the stage. Then came a new variety of test that could be given by one examiner to a hundred or more individuals at the same time. This was the *group test.* This brought a great economy of time and a speedy service that has done much to further the usefulness of tests and, in many instances, appears to have given a higher reliability and objectivity than the individual tests. The group intelligence test was first developed in the United States by Dr. Arthur S. Otis, now director of the Department of Test Service of The World Book Company. When the United States entered the World War, Dr. Otis and his group test conceptions were speedily put to work testing nearly two million of the drafted men.

How do the group tests differ from the individual tests? The great saving of time has been mentioned. Another difference is that the group tests are mostly "paper and pencil" tests while the individual tests were those in which the person being tested replied verbally to questions or problems. So far as the subject matter is concerned there is not a great deal of intrinsic difference.

In the early individual tests of intelligence, for instance, the person being tested was told to put a key on a chair, then open a door, then bring a parcel to the examiner. This is a test of following directions that a normal five-year old child can pass. In the army group tests, a directions test is first in the folder.

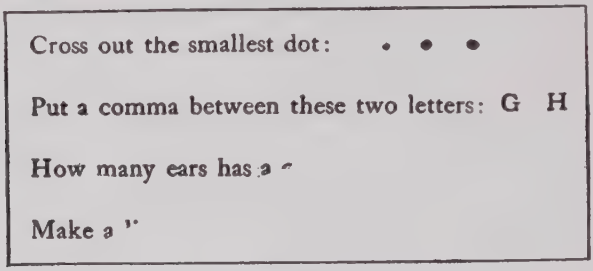
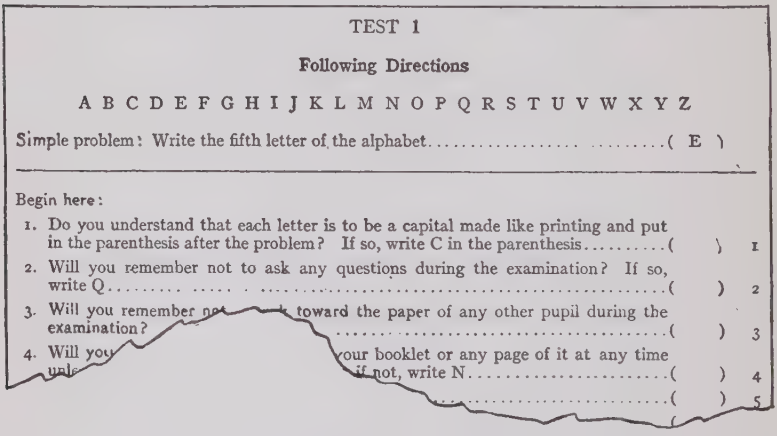


FIG. 133.—A simple directions test.

A group direction test is reproduced in Figs. 133 and 134. Counting and making change are individual tests for low levels of intelligence. Similar tests were included in the army group scale. An individual test can usually be found that to all appearances is a counterpart of each group test.


TEST 1

Following Directions

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Simple problem: Write the fifth letter of the alphabet.....(E)

Begin here:

1. Do you understand that each letter is to be a capital made like printing and put in the parenthesis after the problem? If so, write C in the parenthesis.....( ) 1
2. Will you remember not to ask any questions during the examination? If so, write Q.....( ) 2
3. Will you remember not ... toward the paper of any other pupil during the examination?.....( ) 3
4. Will you ... your booklet or any page of it at any time if not, write N.....( ) 4
5. .....( ) 5

FIG. 134.—Another directions test. (*Otis Intelligence Test: Copyright* 1919, *World Book Co., Yonkers, N. Y.*)

Is anything gained by using a group test? A few years ago this would have precipitated considerable discussion. So far as reliability, objectivity, and validity are concerned, there is little advantage in the one over the other. Some group tests are more

trustworthy than some individual tests, and *vice versa*. The great advantage is the saving of time on the part of the group tests.

Not only time, but skilled help is saved. The individual test is of doubtful value if given by one without special training in test technique. The group tests, on the other hand, have been devised with a view to making them fool-proof, both in giving the tests and in scoring the results.

The group spirit must be mentioned. When a person is tested fact to face with a "nut doctor," it is usually a rather discomforting situation for an adult. Children can be placed at their ease more readily than an adult. When a group of twenty or more men is seen seated along tables working on the items in a group test, often with much hilarity over some of the patent absurdities of the tests, the advantage of the examinee, being part of a group, will be fully appreciated.

VERBAL AND PERFORMANCE TESTS

Part of the tangled maze of tests has been unraveled. Threads of group and individual tests have been discovered. Perhaps

6. One's _____ in life _____ upon so _____
factors _____ it is not _____ to state any single
_____ for _____ failure.

FIG. 135.—A completion test. Words are to be written in the blanks to make sense. (*Trabue Language Scale: Teachers College, Columbia University.*)

these are only opposite ends of the same thread for, intrinsically, there is little difference between these two kinds of tests. This suspicion is confirmed when we begin unraveling the two ends. Apparently it is a two-ply thread. One ply is verbal tests; the other, performance tests. The first ply is tests that depend largely upon language; and other ply is tests that have minimized language practically to the vanishing point. Individual tests may demand language or not, and so may group tests (Figs. 135 and 136).

There are some important factors that favor the performance tests, especially in industrial work. First of all, they can be made almost absolutely independent of education. There is no chance for a smooth-tongued talker being rated too high; there is little chance for the person who has not yet mastered English

being given a handicap that is unmeasured. Some performance tests are of the "paper and pencil" variety. These place the person who has done little writing at a disadvantage and, in groups with mixed schooling, may give more of a measure of schooling than they do of the traits it is assumed that they test.

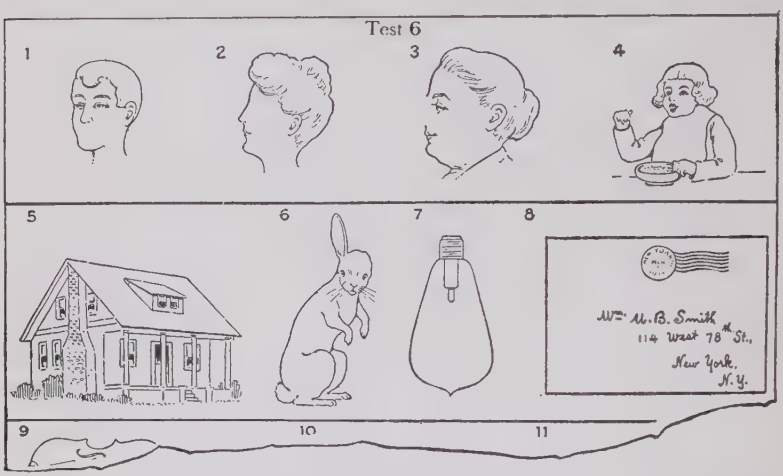


FIG. 136.—A paper and pencil completion test that does not involve language. (*Army Beta Tests.*)

The army test known as *alpha*, sections of which have been reproduced in the figures, was a performance test of the "paper and pencil" variety. Another test, known as *beta*, was a performance test that was also "paper and pencil" but, in place of

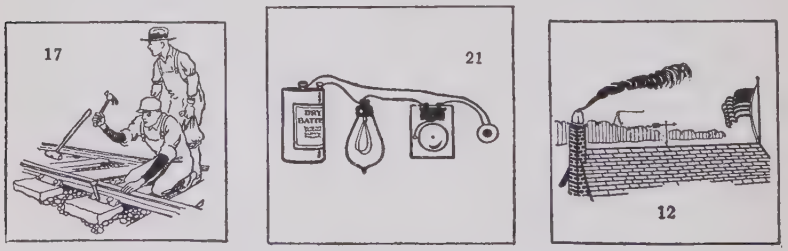


FIG. 137.—There is no question of language in this test. What is wrong in each picture is to be marked with a pencil.

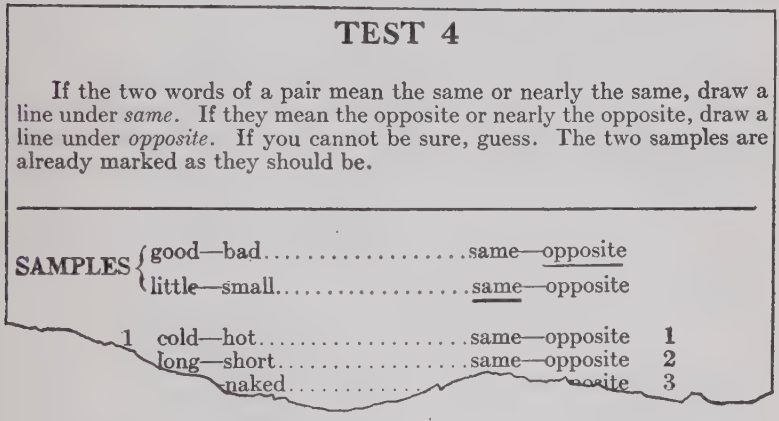
those being examined having to read what was to be done, they were told in pantomime. Instead of being compelled to write numbers or an occasional word, they made simple marks with a pencil. When a regiment of men was sent to the camp psychol-

ogist to take the test, it came to be the practice in some cantonments to ask all the men who had finished the third grade to step forward. These were given the alpha test. Those who had not finished the third grade were given the beta test.

Other tests, such as in Figs. 136 and 137, are performance tests in which no reading or writing is required. In this sort of test the group method often practically merges into the individual method.

WHAT DOES A TEST TEST?

It will be recalled that the method of vocational testing known as the method of essential capacities analyzed the work for cer-



TEST 4

If the two words of a pair mean the same or nearly the same, draw a line under *same*. If they mean the opposite or nearly the opposite, draw a line under *opposite*. If you cannot be sure, guess. The two samples are already marked as they should be.

SAMPLES { good—bad.....same—opposite
little—small.....same—opposite

1 cold—hot.....same—opposite 1
long—short.....same—opposite 2
naked.....osite 3

FIG. 138.—An opposites test. Its verbal counterpart is to ask what is the opposite of black, etc. (*Army Alpha Test.*)

tain apparently fundamental capacities which would be demanded for successful accomplishment. After this was done, tests had to be devised or found that would measure these capacities. It used to be the fashion to have psychological tests named according to the essential capacities that they were supposed to measure so that the labor of finding appropriate tests would be diminished. But even the gods on Olympus quarreled, so what was more natural than that psychologists began to disagree among themselves as to what somebody else's test tested? Psychologist A would work on a test and call it one of mental *association*, but psychologists D and F disagreed by emphatically maintaining that it was a test of *language ability*. The easiest way to slide out of such unpleasant but necessary controversies was to give the

tests a descriptive name rather than a name suggested by the function it was supposed to test.

Hence in place of tests of imagination, will power, concentration, reasoning capacity and inventive abilities, tests were given a name that was descriptive of some of the prominent features of the test. Thus a catalogue lists cross-out tests, number-group checking tests, color-naming tests, ink-blot tests, and mutilated sentence tests without trying to determine any exact mental functions that they might measure.

This gives several advantages. Time which might have been consumed in armchair controversies can now be devoted to an actual testing of the tests. In addition one may be certain of honesty in describing a test. If it is called a test of imagination, one can never be certain that it is right but, if it is called an ink blot test, there is no chance of mistaken identity. The very inability to tell off-hand what a test tests is a provocative stimulus to experiment until it is found out. Most mental functions such as concentration and imagination are non-existent. They are dictionary phrases that are hollow unless one realizes that they are descriptive of different aspects of mental phenomena rather than a definition of different and somewhat independent mental functions.

CAPACITY AND ABILITY TESTS

In an earlier chapter a distinction was made between capacities and abilities. Among the fibers of the tangled threads of tests there are *trade tests* and *educational tests* that apparently test abilities rather than capacities. Of course ability depends, to a great extent, upon capacity but these are tests that are concerned with what a person has accumulated, with his knowledge, and the skill that he has learned in the course of his school work or trade experience. These tests may be either individual or group, verbal, performance, or pantomime.

Then there are tests which have been designed especially to test one's capacities. It is difficult at times to test these without drawing somewhat upon one's abilities but, in general, they test four-fifths capacity and one-fifth ability. Hundreds of thousands of school children have both their capacities and abilities tested annually as a measure of the efficiency of their instruction. If their abilities lag behind their capacities, it indicates that something is wrong.

The most used capacity tests have been those of intelligence. Other capacity tests are those of physical condition, muscular control, and of the sense organs.

TEST 2

Opposites

Samples: up.....(short, down, small, low, young)
hot.....(warm, ice, dark, cold, fire)

DIRECTIONS. Look at the first word on each line, think what word means exactly the opposite of it, find that word among the five words in parenthesis on that line and draw a line under it.

Begin here:

1. east.....(north, west, south, pole, equator)..... 1
2. yes.....(may-be, wrong, no, sure, nothing)..... 2
3. top.....(bottom, side, cover, inside, feet)..... 3
4. before.....(late, now, soon, when, after)..... 4
5. difficult.....(hard, quick, soft, easy, common)..... 5
6. friend.....(brother, acquaintance, enemy, wife, stranger)..... 6
7. succeed.....(win, decline, fail, accede, try)..... 7
8. command.....(officer, shout, order, obey, soldier)..... 8
9. beautiful..(crooked, handsome, old, ugly, dirty)..... 9

FIG. 139.—Another opposites test, but with a type of response that is known as multiple choice. (*Otis Group Intelligence Test: Copyright* 1918, *World Book Co., Yonkers, N. Y.*)

TEST 8

Notice the sample sentence:

People hear with the eyes ears nose mouth

The correct word is ears, because it makes the truest sentence.

In each of the sentences below, you have four choices for the last word. Only one of them is correct. In each sentence draw a line under the one of these four words which makes the truest sentence. If you can not be sure, guess. The two samples are already marked as they should be.

SAMPLES
People hear with the eyes ears nose mouth
France is in Europe Asia Africa Australia

1 The pitcher has an important place in tennis football baseball handball..... 1
2 Cribbage is played with rackets mallets dice cards.....
3 The Holstein is a kind of cow horse sheep goat.....
4 The most prominent industry of Chicago is packing brewing automobiles flo
5 The topaz is usually red yellow blue green.....
6 The Plymouth Rock is a kind of horse cattle granite fowl...
7 Irving Cobl
8 Cl

FIG. 140.—A test of range of information with a multiple choice response. (*Army Alpha Test.*)

HOW TO MAKE A PSYCHOLOGICAL TEST

Punch's famous advice to the young man about to get married was "Don't." That is my advice to the person who wants to

make a psychological test. This is because there are too many good ones to be had without going to the trouble and expense of making one that may be a failure. What is needed is not more or new tests but more insight into the validity of the existing hundreds of tests. Satisfactory tests that can be put to a variety of uses are available. Use these rather than attempt something original. There are enough constructive geniuses at work on test construction at present to supply future needs for years. There is little need for the person in industrial work to devise new tests, and chance their reliability and objectivity, when his work could be simplified by using available tests whose objectivity and reliability are known, and determine only their validity for his practical purposes.

THE EARMARKS OF A "GOOD" TEST

Any test to be valuable must give the same measure or score every time it is applied to the same object or person: must give the same scores regardless of who does the testing; and must really test what it purports to test. A thermometer will give the same reading for boiling water every time it is used, it will give the same reading regardless of who uses it.

A test of "charm" is not worth its keep. No two persons will agree unless they are in collusion. One person's judgment of charm keeps shifting from day to day, and it is likely to be knowledge, or dancing grace, that is tested in place of charm.

Are psychological tests worth their keep? Some of them are; most of them in fact. Some of these tests are worth much more than others. But they are all worth more than the usual employment methods.

The exact worth of these tests as measured by their consistency from day to day, by their consistency from user to user, and by their internal consistency of measuring what they aim to measure, can be determined to the exact per cent by mathematical methods. This determination is done by the devisor before turning his test loose on the public.

This testing of tests has revealed many characteristics that mark the test that is worth its keep. If a so-called psychological test is offered to you, measure it by these characteristics:

1. The Individual Items or Questions in a Test Should Require a Minimum of Writing.—The less writing that is necessary, the better the test except in cases where rapidity of writing or its legi-

bility is an important item in itself. Then tests of writing may be used. If writing is not minimized or eliminated, a test quickly becomes one of writing rather than of anything else. The person with low abilities in everything but writing is given a fictitious appearance of ability which he does not possess, if writing occupies a more prominent place than making marks or writing a single word. The uneducated person or the foreigner is unduly handicapped if writing is required.

At the same time, it is difficult to test more than one person at a time unless writing or marking is used. With a little ingenuity almost any test can be reduced to marking only. In the pictures in Fig. 137, for instance, those being tested are told to mark what is wrong in each picture. If there are foreigners being tested, this direction can be made clear to them by pantomime as was done in some of the army psychological testing.

In case literates are being tested, simple reading may be used in place of pictures and the response can consist of a check mark, or underlining as in Fig. 138, or filling in blanks as in Fig. 135.

2. The Individual Items or Questions Should Be Specific and Definite.—Do not hand the person being tested the test with this direction, "Work on this a little while." Tell him to put it together. Do not ask, "Do you have many headaches?" Find out how many he has had the past month.

3. There are No "Trick" Items.—Double negatives and words with double meanings are to be avoided, unless it is desired to devise a test for canniness at seeing through such trickery. If the applicant is being tested on his range of general information, and a few trick questions of this sort are inserted, the test's validity is at once undermined, for the final score will not only reveal his general information but his ability to get around trickery of this sort as well.

4. There Should Be a Large Number of Items.—The more one gets the applicant to do in a test, or to tell about himself, or to tell what he knows about the work from his past experience, the greater the reliability of the findings. If eight things in place of two that an experienced applicant knows about the work are ascertained, the reliability of the results is doubled. If eighteen in place of two, it is tripled.

In personal interviews this is time consuming but, if a group psychological test is used, several hundred items can be used in an hour with no great demand upon the time of the employment

department. This is another point in favor of the economy of the psychological test method.

A large number of items also increases the cheat-proofness of the test. If four or five questions are asked, an applicant who has just been interviewed can spread the information around the waiting-room with a resultant, almost complete, loss of validity. If he has been faced with one or several hundred questions, however, he can at most give only little helpful information.

5. The Test or Interview Should Proceed in Exactly the Same Way for Each Applicant.—There should be a standard, typewritten, or printed form that is followed verbatim in sizing up the applicants. This must needs be simple enough for all to understand but, even in the case of the applicant with superior linguistic abilities, no deviation from the verbatim procedure should be permitted. Otherwise the conclusions will be invalidated and the test will not be a test at all. Where several interviewers are used, the results will vary from one to the other unless this rigid, verbatim adherence to the directions is followed.

Casually it would appear difficult to keep to the strict letter in interviewing, but such has not been found to be the case when serious attempts have been made to standardize the interview. In Fig. 129 there are reproduced some standardized interview questions that have been developed to a high degree of consistency from interviewer to interviewer, and to a high degree of validity in really indicating trade skill. Standardized interviews, as shown in Figs. 129 and 130, have also been developed in which the questions are supplemented and made simpler by the use of pictures.

6. Each Item Should Admit of Only One Response That is Right.—There are two reasons for this. In the first place, if there is a possibility of several answers being right, or several partly right, the personal judgment of the examiner immediately enters, and the method deteriorates into one in which there is too great a degree of subjectivity. A second reason is that it makes for economy of time and expense if the items can be scored or graded by quick mechanical means. In a test of the sort shown in Fig. 140, for instance, only one of the responses is right. A stencil made of celluloid shows where the underlining should be; the transparency permits one to see where it is. If these do not coincide, the question is wrong. There is no chance for doubt in this case, no need for delaying

things by making a personal judgment, no variation from one applicant to another because the examiner's judgment varied a little. The examination can be scored by the cheapest grade of clerical help while the employment engineer is free to spend his energies in new and constructive work.

It should always be the aim to make use only of test or interview items that permit of scoring with a stencil, or as right or wrong according to a standardized method.

7. A Series of Test Items Should Be Too Hard for Anyone to Make a Perfect Rating.—The man who makes a perfect score is not measured adequately. He can do more than the test or interview indicates; he should be doing that. Unless there are items that are too hard, or time is not given to finish all of them, the test is not measuring the better applicants well.

8. Conversely, a Series of Test Items Should Not Be Too Hard for Anyone To Make Something on the Measures.—People with zero abilities probably do not exist. If one makes a zero record on a test or interview, it means that he has not been measured.

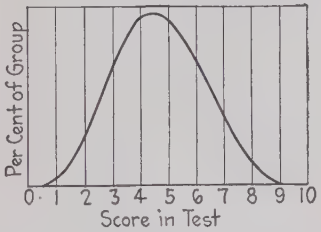


FIG. 141.—A test that has the scores of 100 men distributed like this is not as desirable as one with the scores distributed as in the following figure.

9. The Degree of Ability, as Expressed in Final Scores, Should Have a Wide Range.—If those who are examined are

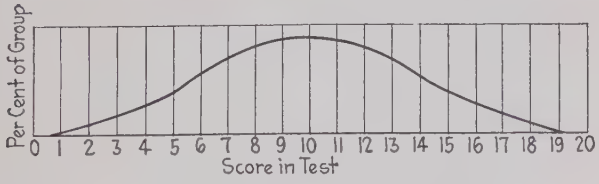
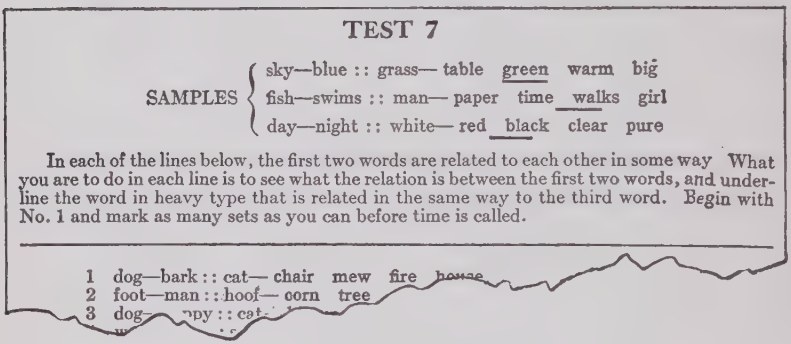


FIG. 142.—The same 100 men have their differences enhanced by this test. (See Fig. 141.)

bunched together as shown in Fig. 141, they are not adequately differentiated. If, on the other hand, they are scattered as in

Fig. 142, the usefulness of the method is increased, and in most cases the accuracy is greatly increased if all other things are equal. This fine discrimination of Fig. 142 as compared to the coarse discrimination of Fig. 141 may usually be effected by having a large number of items, and by having a fine method of scoring the responses.

10. Each Test Should Have Been Found to Be Indicative of the Abilities or Capacities Wanted.—Tests and interviews are not conducted for the purpose of impressing the new employee with his good fortune in being taken on the payroll. Their principal aim is to tell with some certainty which applicant should be taken. This certainty is a variable quantity in the case of traditional methods. This variability, which often amounts more to uncertainty than to certainty, can be reduced



TEST 7

SAMPLES
sky—blue :: grass— table green warm big
fish—swims :: man— paper time walks girl
day—night :: white— red black clear pure

In each of the lines below, the first two words are related to each other in some way What you are to do in each line is to see what the relation is between the first two words, and underline the word in heavy type that is related in the same way to the third word. Begin with No. 1 and mark as many sets as you can before time is called.

1 dog—bark :: cat— chair mew fire house
2 foot—man :: hoof— corn tree
3 dog— ppy :: cat—

Fig. 143.—An analogies test. (*Army Alpha Tests.*)

most by using only items that have been *experimentally demonstrated* to go hand in hand with superior performance in the work under consideration. Items which do not supply such information are more than non-essential. In case the applicant is selected or rejected by his composite score, this score is decidedly unfair if it reflects his responses to irrelevant items.

What items are irrelevant? Is it an irrelevant item to ask the applicant to tell whether this is true or false when put in its right order?

children heaven good to go

That can only be answered by actually comparing ability in this item with later ability on the job. The surprising thing is that just such apparently pointless items as this are often found to

be consistently and closely related to work which to all outward indications shares nothing in common with the test.

There are some items that may be exempted from this canon. Such are telephone numbers, residence addresses, and other items of information that are used more for future convenience than for any insight they may give into fitness. These should plainly not be taken into consideration when a decision is being reached on the suitability of an applicant.

MEASURING A TEST

Some insight may be gained into the way in which a test measures up to the three principles of testing by an examination directed along the lines indicated in the preceding section. The final measure of the test, however, should be mathematical.[1]

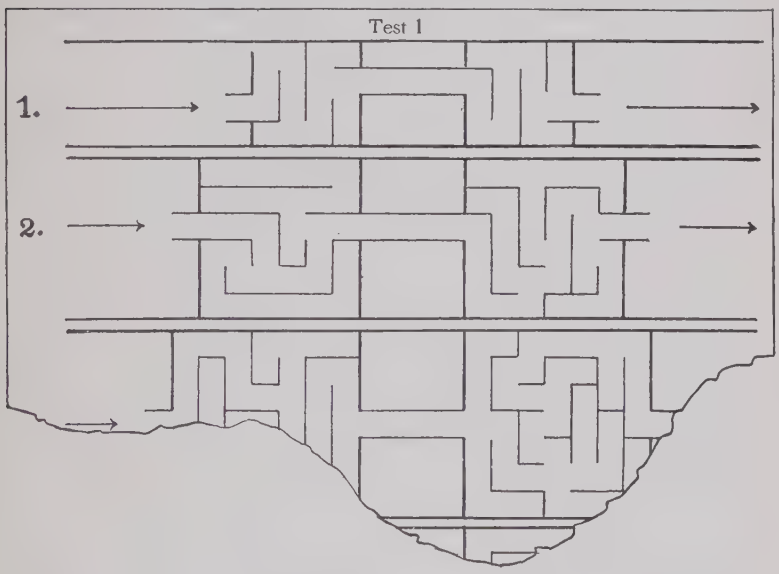


FIG. 144.—A maze test. Start with the arrow on the left and end with the one on the right without crossing a line. (*Army Beta Tests.*)

Reliability.—The reliability of a test is influenced by two factors. One factor is that individuals being tested vary from day to day and from hour to hour. The other factor is intrinsic in the test itself. Both can be accounted for mathematically. The simplest way to do this is to correlate (product-moment method) each individual's standing on the first half of the test with his

[1] For detailed discussion consult the references.

standing on the second half of the test, or to correlate his standing on the even items with his standing on the odd items. Where alternate forms of tests are available, the score of each individual

TEST 8

Similarities Test

Samples: hat, collar, glove.....hand, cane, head, shoe, house
rose, daisy, violet. .....bush, red, plant, bed, pansy
desk, bed, chair.... .....book, table, floor, pencil, coat

DIRECTIONS. Find the way in which the first three things on a line are alike. Then look at the five other things on the same line and draw a line under the one that is *most* like the first three.

1. red, white, green.... .. ... .rose, paper, grass, soft, blue..... .. 1
2. apple, peach, pear.....seed, tree, plum, juice, peel.. . . 2
3. pan, bowl, basket.....pail, handle, knife, fork, spoon. .
4. snake, cow, sparrow . . ..tree, doll, pig, feather, skin...
5. ship sail, automobile, wheel

FIG. 145.—A similarities test. (*Otis Group Intelligence Test: Copyright* 1919. *World Book Co., Yonkers, N. Y.*)

TEST 5

The words A EATS COW GRASS in that order are mixed up and don't make a sentence; but they would make a sentence if put in the right order: A COW EATS GRASS, and this statement is true.

Again, the words HORSES FEATHERS HAVE ALL would make a sentence if put in the order ALL HORSES HAVE FEATHERS, but this statement is false.

Below are twenty-four mixed-up sentences. Some of them are true and some are false. When I say "go," take these sentences one at a time. Think what each would say if the words were straightened out, but don't write them yourself. Then, if what it would say is true, draw a line under the word "true"; if what it would say is false, draw a line under the word "false." If you can not be sure, guess. The two samples are already marked as they should be. Begin with No. 1 and work right down the page until time is called.

SAMPLES { a eats cow grass.....true..false
horses feathers have all.....true..false

1 cows milk give.....true..false 1
2 write are with to pencils.....true..false 2
3 are and apples long all.....true..false 3
.....true..false

FIG. 146.—A combination true-false and mutilated sentence test. (*Army Alpha Tests.*)

on one form should be compared with his standing on the other forms. The reliability of most psychological tests is known; a test should not be purchased unless its reliability is stated. This is a specification that should be demanded.

Most psychological tests will yield a correlation of over 0.90 for reliability.

Objectivity.—The easiest way of measuring this is to have Jones give one half of a test and Smith the other half of the same test, or alternate forms of the same test, to the same group of individuals, and correlate the results. This correlation is influenced by the reliability of the test under consideration and allowance must be made for this variable.

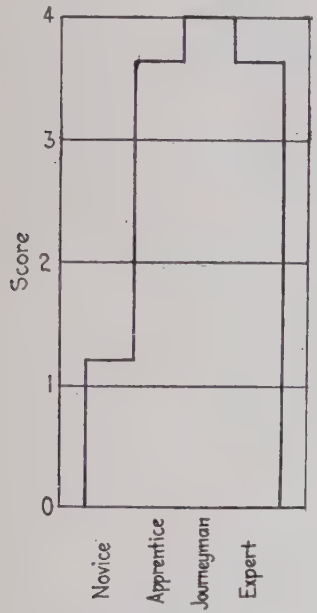


FIG. 147.—This test is not satisfactory.

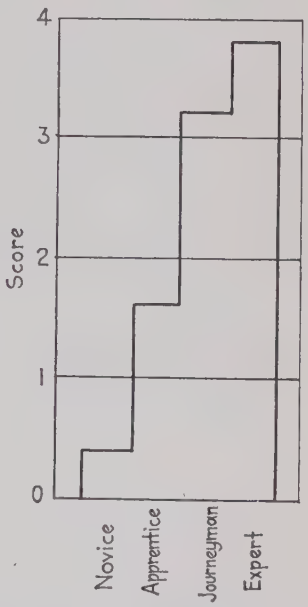


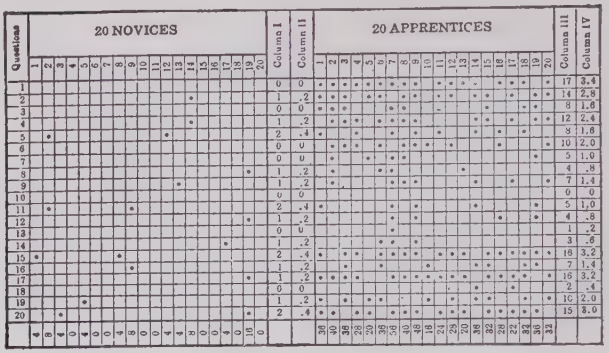
FIG. 148.—This question differentiates the various grades of workmen.

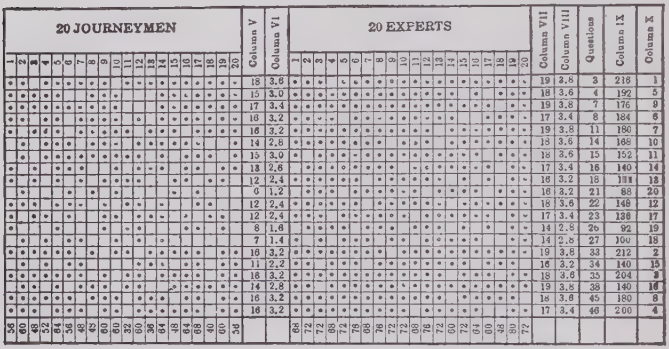
The objectivity of many tests is known. A test should not be purchased unless its objectivity is stated. This is a specification that should be demanded.

Most psychological tests will yield a correlation of over 0.90 for objectivity.

Validity.—A test can have only random validity unless it is objective and reliable. Its validity is to be determined in the same way as the significance of various items of personal history have been determined. These are the ways taken up in Chaps. XI and XII.

The validity of a test must be determined for each plant. There are three essentials in this: (1) a satisfactory measure of





This chart shows all the statistical data used in the making of the test. Of the 50 questions originally assembled and used in the samplings, all but the 20 shown were rejected for various reasons. Each dot denotes a correct answer having a score value of 4. There were no partial scores allowed in this test.

Column I shows the number of correct answers to each question by Novices. (Columns III, V and VIII show similar facts for Apprentices, Journeymen and Experts respectively.)

Column II shows the average score of Novices for each question. Column I shows that on question 5, 2 out of 20 Novices scored 4 each, making a total Novice score of 8. Dividing by 20 gives an average of .4 as shown in Column II. (Columns IV, VI and VIII show similar facts for Apprentices, Journeymen and Experts respectively.)

Column IX shows the total score of Novices, Apprentices, Journeymen and Experts combined for each question, obtained by adding, in each case, Columns I, III, V, and VII, and multiplying by 4. The highest score indicates the easiest question, number 1 in Column X.

The unnumbered column signifies number of questions in original series.

Column X shows the 20 selected questions as they will appear in the completed test, arranged in ascending order of difficulty.

FIG. 149.—How test questions are selected and weighed. (*Data from Dr. J. Crosby Chapman.*)

relative success (Chap. IX); (2) reliable and objective test scores of workers who *have entered* the work (Chap. XII); (3) a person qualified to relate these (Chap. I).

The validity of tests is a variable quantity. Some tests have a validity of almost zero; others have a validity of around 0.80.

THE ACCURACY AND USEFULNESS OF TESTS

A question that one is frequently asked is, "are tests absolutely accurate?" In comparison with traditional employment methods, they almost are. In earlier chapters we have found that critical experimental studies of the usual methods of selection revealed that they were of almost zero accuracy. Any increase over the inaccuracy of traditional methods is desirable. Tests give not merely a slight increase; they give a great increase. Tests are so much more accurate that the only reasonable conclusion is to use them.

How much dependence should be placed upon a test in employing workers? That depends to a large extent upon how valid the measure of success used in validating the test was. It depends too, upon how high the test correlated with the criteria of success. The higher the correlation with success the more dependence can be placed upon the test scores in placing workers.

SUGGESTED READINGS

Brown, Wm.: "The Essentials of Mental Measurement," G. P. Putnam's Sons, 1911.

Chapman, J. C. and D. R.: "Trade Tests: the Scientific Measurement of Trade Proficiency," 435 pp., Henry Holt & Company, 1921.

Kornhauser, A. W. and Kingsbury, F. A.: "Psychological Tests in Business," 194 pp., University of Chicago Press, 1924.

"Memoirs, National Academy of Science," 890 pp., No. XV, 1921.

Monroe, W. S.: "An Introduction to the Theory of Educational Measurements," 364 pp., Houghton Mifflin Company, 1923.

Pintner, R. O.: "Intelligence Testing," 406 pp., Henry Holt & Company, 1923.

Ream, M. J.: "Ability to Sell," 64 pp., William and Wilkins Co., 1924.

Stenquist, J. L.: "Measurements of Mechanical Ability," 101 pp., Teachers College, Columbia University, 1923.

Toops, H. A.: "Tests for Vocational Guidance of Children Thirteen to Sixteen," 158 pp., Teachers College, Columbia University, 1923.

There are three principal sources of tests in the United States. These are The World Book Company, Yonkers, N. Y.; C. H. Stoelting Co., Chicago, Illinois; and The Bureau of Publications, Teachers College, Columbia University, New York, N. Y. Descriptive circulars and price lists can be obtained from these houses.

CHAPTER XV

THE LIMITATIONS OF PSYCHOLOGICAL TESTS

Passing now to the positive phases of employment psychology, a discussion is entered upon at once which in some points may be more or less controversial. No one realizes this better than the author. In the selection and treatment of topics, however, he has been guided by the major consideration of presenting what has been found useful in actual employment procedure. Armchair objections have thus been summarily neglected where the pragmatic test has been passed.

Selecting workers so that each one will be perfectly fitted for his work will not usher in an industrial millenium. Productivity is not dependent solely upon the proper selection of the worker, or even entirely upon the worker. Routing, for instance, is a mechanical affair and practically without bearings upon human beings. Yet it has been found important in production. So, also, for inventory control. Perfect selection will not bring a plant with antiquated routing, inventory control, and cost accounting into the first ranks of dividend earners.

Industrial production centers around the human being in four general divisions of the administration. These are:

1. Working conditions.
2. Motivation.
3. Training in the factory.
4. Selection of workers.

Perfect selection, for instance, can scarcely offset badly lighted and improperly ventilated workrooms. The best efforts of the employment department may be counteracted by the fatiguing postures which workers must assume because of poorly engineered benches and stools. These are important factors of the working conditions in which psychological tests cannot be of use, unless it be in selecting a plant engineer who will measure up to the responsibilities of production his job involves.

The motivation of workers is almost a virgin field. Wage scales, welfare activities, safety committees, official titles, ability

of executives to inspire confidence and loyalty are all involved. Where plant morale is low, it is futile to expect psychological tests, or any method of selection for that matter, to locate a worker who will not sulk about overtime, restrict output whenever possible, or care as little about the quality of his work as a cat cares for a dog.

I recently visited a concern with a sales total last year of $75,000,000. On the top floor of their plant is a training department

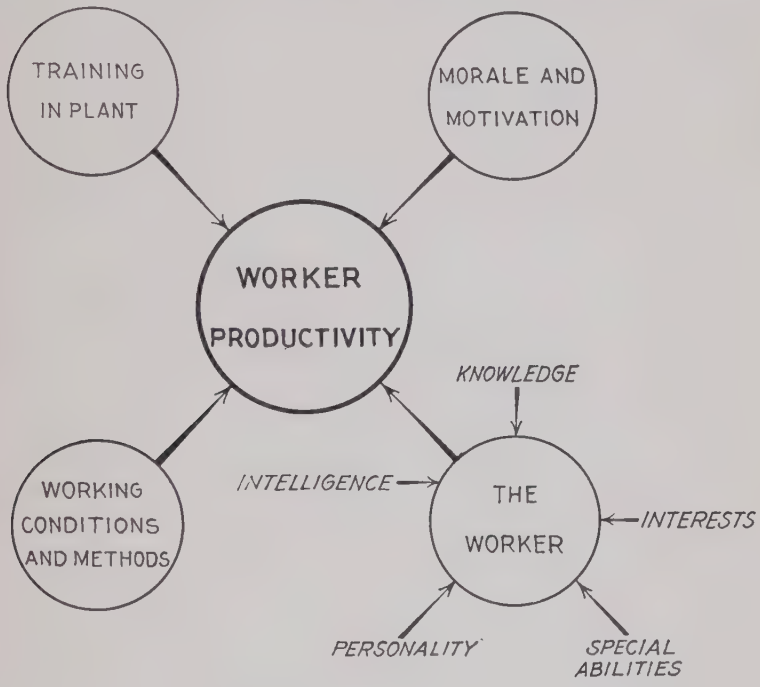


FIG. 150.—The worker himself is roughly only one out of four vital factors in production.

against which an overhead of nearly $100,000 is charged each year. The firm has found that, in spite of the heavy expense, the training department pays dividends and is expanding the work. This is another factor in the worker's contribution to production in which the employment department is usually without power. In many plants it is not the selection of workers that is at fault so much as it is the lack of proper training.

Before a diagnosis of poor selection of workers is made and psychological tests are recommended as treatment, an examina-

tion should always be made of the other vital organs of a factory: working conditions, motivation, and training. I know of several small concerns that had been on the verge of engaging an employment psychologist at a salary which would eclipse the general superintendent's income, but which, after a survey of conditions had been made on second thought, had solved their troubles by getting a more up-to-date plant engineer, or by shifting a general foremen to form a training class, or, in one astonishing case where motivation seemed to be at fault, by appointing several worker committees to take charge—without additional pay and on their own time—of plant grounds, safety work, and souvenirs the company sent their customers!

FIVE QUALIFICATIONS OF EACH WORKER

In the present status of psychological tests, five components of each worker's mental qualifications for his job may be tested, and the results are usually reliable, objective, and valid. An applicant may be high in one of these qualifications but low enough in another to disqualify him for the particular position under consideration. Such, for example, is the young man who has adequate intelligence for a welfare supervisor, but whose entire interests are bound up with mechanical activities; such is the bench mechanic who is at the lead of his department in skill and production, but who should not be considered for the work of foreman on account of personality traits which make him unpopular with his fellows.

Intelligence.—For each job a certain amount of intelligence —general mental ability, power to learn—is needed. As indicated in the illustration just given, however, plenty of intelligence must be supplemented by other mental qualities to qualify the worker for the task.

Personality.—Until recent years, little experimental work had been done with psychological tests of personality traits as related to fitness for various types of work. Each employer, however, carries a mental picture of the personality he likes to find among sales applicants, among foremen, among toolmakers, or among any others whom he employs. In some instances, personality traits are so markedly of the wrong sort as to disqualify a worker when promotion to a position of greater responsibility is contemplated. In the opposite case, sometimes grumbling is heard among workers because promotion has come to one of their group

who is poor as a bench mechanic, but who has a preeminent assortment of personality traits which qualify him for promotion to a supervisory position.

Knowledge.—Each employer expects a certain amount of general training from his employees, in addition to what he may give them in his training department. The stenographer, for instance, should be able to spell "Cincinnati" without having to ask her neighbor or to consult the dictionary. She should know where to divide "preference" without having to consult either of the above sources.

Mechanics on job work should be apt in arithmetical computations. Ludicrous mistakes can be avoided if office clerks know some details of American geography. Very useful tests are available for measuring this type of information.

Interests.—It is a commonplace observation that one is most successful in the work in which he is interested. As a matter of fact, vocational counselors seldom go wrong if they direct a young man in work for which he has mediocre abilities but high interests, rather than into work for which he shows little interest but high abilities. The practical difficulty in *advising* an individual in which direction to go is to know how low the real ability has to be to offset a high interest. In *selecting* an individual from a group of applicants, this difficulty is not present for the plant is able to demand high standards both in interest and genuine ability.

The size of the wage envelope is sometimes the principal interest of a large number of applicants. This is especially so at the lower end of the wage scale where money is a pressing affair. At the higher end of the industrial scale, the more ideal arrangement by which one works at what intrinsically interests him is more commonly found. Two illustrations were impressed recently upon my mind. One case involved the vice-president of a concern who was engaged as general manager of a company in similar manufacturing work. When he had accepted and returned to his home, he had the afterthought to telegraph to find what salary the new position carried.

Another instance was that of a student of mine who last May went to New York to be interviewed relative to doing psychological work with a corporation having 19,000 employees. He accepted the job and on his return could not tell me what his wages would be for he had forgotten to inquire. He accepted

the particular work because of its high intrinsic interest for him. And at Christmas he was the only employee of the company to receive a bonus, a weekly raise, retroactive to the beginning of his employment.

Special Abilities.—In the state school for the feeble-minded at Rome, New York, is confined a near genius who can tell with just an instant's thought on what day of the week August 24, 1878, occurred. In spite of being a mental defective, this patient has remarkable abilities in one line of activity. It is recalled how Washington Irving was scarcely able to say a word when called upon to speak, yet he produced beautiful literature. Conversely, Patrick Henry was preeminent as an orator, but even his best friends could seldom understand what he had in mind when he wrote a letter.

These weaknesses and strengths in outstanding cases of this sort should not be confused with the general run of human beings. Because a worker has remarkable abilities as a mechanic, there is no guarantee that all of his abilities are developed to the same extent. As a rule, the abilities of the ordinary individual are developed fairly equally in most directions. But the exceptions to this rule are so frequent that special-ability tests must be used. Even in the case of general intelligence, a poor memory may unduly penalize one person, while another gains unfair advantage on some general ability tests by being a genius at computation.

Special-ability tests are available for mechanical aptitude, music, file clerks, railway mail clerks, and a large number of specialized occupations. As a rule, the standards and tests themselves have to be developed for a particular plant, since an assembler at one plant has work very different from an assembler in another plant.

DO TESTS SUPPLANT HUMAN JUDGMENT?

A manufacturing concern with 21,000 employees "installed" psychological tests in the period of overconfidence following the war. The employment manager called his interviewers together; they carefully looked over the Army intelligence tests, and after a number of conferences of this sort set up test score standards which were used in engaging applicants. Three years ago the company engaged a psychologist for full-time service. For three years now, he has had the unusual task of collecting data to convince the employment department that the standards which

they had arbitrarily established in many jobs had no bearing at all upon the workers' qualifications!

This instance is cited to illustrate the fact that it is not merely psychologists who are oversold on the use of tests in employing workers. I can understand the above situation and appreciate the progressive spirit but not the judgment of the employment manager. There should be not an iota of sympathy, however, with a person who poses as a professional psychologist, but maintains that tests will do all that has been claimed for fatigue study, time study, motion study, planning, a differential wage, and many of the new ideas continually being agitated before industrialists. All of these have their important values, but usually none of them should be accepted with a full belief in all the claims of their proponents. Psychological tests will be found a help, not a solution.

Applied to the industrial situation, tests provide data to be used in reaching a conclusion. They provide facts to help in judging, but they do not supplant judgment. In this they are similar to mechanical calculating machines. And they are likely to require "service" about as frequently as office machines. In this respect, however, there is one important breakdown in the analogy: When an office calculator is out of order the trouble is soon discovered, but psychological tests can be used blissfully without knowing whether they are working or not, unless they are checked up by someone skilled in this work. Unless they are periodically checked, there is no way of knowing just how much they are bringing the employment department out of the red ink, or putting it into the red.

TESTS FAIL TO BUILD MORALE

The fourfold classification of motivation, training, working conditions, and selection is somewhat artificial in the sense that it overlaps. Morale is to be built in the process of selection and through the training department as much as through the activities of a "Welfare Director."

An employment interview has failed, even though a perfect workman is discovered, unless from the first words and approach of the interviewer a friendly, cordial, lasting spirit of cooperation has been started. As my observations increase, I am coming to believe that employment workers fail more through establishing poor contacts for the firm than they do by selecting poor workers.

A psychological test is obviously an inhuman, mechanical sort of a thing that can do nothing by way of building morale except to amuse or irritate an applicant. Even though its use improves selection, as it generally does, the morale building factor is practically zero. Hence, all the more need of using the tests to supplement, not supplant, the interview.

The question is often raised regarding the possibility that mental testing builds up antagonism among the workers. The answer must be: Usually it does not and, in the cases in which it does, it is usually the result of the way the tests and especially the test scores have been handled.

A manufacturer of electric appliances who has a large plant in the East engaged a psychologist to develop tests especially for his workers. The psychologist judiciously spent most of his first year in building up faith among the executives and other workers. During the noon hour, for instance, he was always on the job to let employees try the tests "just for the fun of it." One employee told another and soon he was busy outside of working hours giving the tests to workers who wanted to find out what the tests were like and how well they could do them. This was a slow way of gathering norms to correlate with production records, but it had the advantage of building rather than undermining morale.

Had this particular employment psychologist used tests which were not intrinsically fascinating or not obviously related to the employees' work, his efforts undoubtedly would have been immeasurably handicapped. These advantages of tests, which in themselves are interesting and which are plainly related to the work at the bench, are very important considerations in introducing tests to old employees.

SELLING APPLICANTS ON THE TESTS

While it is necessary to handle the testing of employees with the greatest diplomacy, less care needs to be exercised in dealing with applicants. Too often, however, such consideration is almost entirely neglected. This may bring on near havoc, since some of the applicants affected are to become employees.

The vital factor in selling applicants on the tests, and the foremost consideration for the employer to keep in his mind is the answer to: "What kind of work can the applicant *do best?*" The question should not be: "Shall we hire him or not?" When

the former point of view is maintained and the applicant is told that he is to be given a series of stunts to find out what kind of work is best for him personally to follow, he at once enters into interested cooperation for it is precisely that question which has been concerning him ever since he first started to work. This attitude of the employment man should be genuine, not a mere pose. The social obligations of his position and his duty to the firm in building good will in the locality demand that he become steeped with this *spirit of guidance.*

The way in which psychological tests are received by the workers or applicants depends to a surprising extent upon the way in which the scores are interpreted for the individual. It is possible for all scores made to be interpreted in a *positive* manner. The scores in themselves are practically meaningless and, for this reason, there is no need for the applicant to know what his score was. The scores are of significance only when compared with the scores the average person makes, or when interpreted in terms of a critical score found for any one job.

More significant than the meaninglessness of the score itself is the fact that there is a tendency for workers to think of scores in terms of their school grades. Thus, a score below 70 may mean failure to them, while as a matter of fact in many tests the highest possible score is less than 50.

The scores should be interpreted positively for the worker by saying to a worker with a low intelligence and a high mechanical ability score: "Everybody has their ups and downs in abilities. Patrick Henry was a wonderful speaker, but could not write a letter his friends could understand. You probably know someone who is very smart, but cannot tell one tune from another. Now, in your case, we have found that your abilities are strongest in mechanical work, that is, you have practical abilities for making and repairing things. You aren't so strong in book work and other impractical things."

Notice the significance of the term "impractical." That will prevent a wrong interpretation by the applicant which suggests he is inferior. And they all like to know that even Patrick Henry had his weak spots.

It should also be noted that the information as given the applicant amounted in essence to *guidance.*

When the test results are properly interpreted and tactfully broken to the applicant, the employment interviewer is going to

receive more heartfelt thanks from those he cannot hire than he is used to receiving from those he does engage!

The proper punishment for the interviewer who bluntly tells the applicant the scores he made is that of hanging on his own door the interviewer's own test scores, boldly etched on a bronze plate, for the world to see.

PLACEMENT BY ELIMINATION IN ORDER

Physicians diagnose by a method known as diagnosis *par exclusionem in ordone*. The patient has a high fever. He can move all his limbs and has suffered no falls or accidents recently. Hence, it is not a broken limb. That is eliminated. He has a rash on his face. Non-rashing fevers are at once eliminated from consideration. There is no rash on the palms of his hands. One rashing fever is eliminated. His skin whitens when pressure is applied, eliminating another disease.

The same careful procedure can be used in employment work, and with the aid of psychological tests can be made speedy as well as fairly trustworthy, more trustworthy, in fact, than most employment diagnoses are made.

John O. Essex stands in front of us. On our desk is a summary of his test scores on a small file card. Glancing over this card, we notice that his intelligence score shows a level above that of an unskilled laborer, but below that of executives. Two large groups of possible occupations are at once eliminated from consideration.

His special abilities reveal low clerical-work scores and high mechanical-ability scores. So far, the indications are for mechanical work of a non-executive, non-laborer kind.

Personality-test results reveal the introverted make-up. Supervisory work or foremanship is eliminated accordingly, as is also coarser mechanical work.

The applicant's interests and knowledge center around electrical work and his record also shows a preference for working alone. Here is just the man we want to do repair work on the delicate electrical recording instruments in wide use throughout the factory, providing his knowledge of electrical instruments of this general type is adequate.

This method of judging applicants should not be the result of psychological tests. Whether tests are used or not—and they usually are not used—the successful employer follows this proce-

dure in engaging workers. Tests, no matter how perfect they may be, will never take the place of ripe judgment. But they do offer at present the best-known means of discovering facts about the applicant's real abilities and thus afford a valuable guide to assist the interviewer to a mature decision which will pay a dividend to the applicant as well as to the company.

RULES TO FOLLOW IN TESTING

The great value of psychological tests is in their giving scores which are more constant and steady than the usual estimates used in employment selection. This reliability will not be present even with tests, however, if they are not given under *carefully standardized conditions.*

A quiet room, provided with adequate illumination and a steady temperature should be used. No one should enter or leave the room while tests are being given. Ample and convenient writing space is necessary. Armchairs from the cafeteria will not do. Pencils sharpened at each end should be supplied, with an ample reserve for use in case of breakage.

If the applicant is frightened, ill at ease, or surprised by being tested, either put him at ease and gain his confidence, or, if that is impossible, let the testing go.

Instruction booklets, supplied by those who sell the tests, contain directions for giving them. These should be followed to the letter, absolutely! If the tester wants to become original in giving the tests he may do so, but should bear in mind that he will have a year's job ahead of him to restandardize the tests for the originality he has evidenced.

CHAPTER XVI

INTELLIGENCE TESTS IN GUIDING APPLICANTS

In the present development of employment psychology, the tests of widest usefulness in indicating an applicant's *general* vocational strengths are what are commonly known as "intelligence tests." Scores on tests of this sort have been taken from several million school children, factory workers, and army draftees.

For each job, there is a minimum of intelligence a worker must possess. If he has too little, his rate of catching on to the work will be slow, his poor grade and amount of production will be costly, and his lack of foresight will make a slack season of work throw him onto the public charities.

For many tasks, conversely, there is an upper limit of intelligence, a certain high intelligence score above which the worker will be bored, uninterested, and soon striking out for other work. While they catch onto the tricks of a new job with pleasing agility, they soon terminate their connection with the company, unless promoted to a higher grade of work where all of their native powers of intelligence will more nearly be required for the performance of the task. The danger of applicants having too high a score in intelligence is not so great as the menace of the low score, yet it is an important fact to consider in guiding an applicant into his best work with the company.

ARE MENTAL STANDARDS OF INDUSTRY LOWERING?

There are many who maintain that as more automatic machinery is introduced into industry the demands upon the intelligence of the workers is lowered. In other words, many feel that industry is becoming more moronic each year. This opinion is apparently strengthened when we find members of colonies established by schools for the feeble-minded earning fair wages in many plants.

These cynics, who are usually innocent of any factory contacts or experience, forget that as a complicated new machine is

introduced it takes a greater amount of ability to plan, construct, and maintain that machine than the simpler one it replaced. They also lose sight of the fact that there are at least 700,000 feeble-minded at large in the United States. These are potential social menaces unless industry finds for them some work which they can do profitably to industry and themselves.

FIG. 151.—Many highly lauded occupations do not require high intelligence. Every girl in this shop is feeble-minded.

What does actual experience show? Undoubtedly, there are large numbers of workers who are engaged at tasks which are much too simple for them and in which they do not utilize their full intelligence. The differential between the intelligence they have and what their job uses represents a real loss which should be figured into the excessive overhead of our present civilization. An overhead loss can be demonstrated from the

books of any factory, however, on the opposite situation: workers with eight units of intelligence trying to hold down a job that requires a minimum of twelve units of intelligence.

A company in Chicago employing 6,000 new men each year has carefully established minimum intelligence standards for its varied tasks. Their experience does not bear out the assertion that industry has become moronic, for they are unable to find applicants enough each year to secure the 6,000 men with the intelligence they require. This situation exists in spite of the fact that the minimum intelligence required for the majority of their operations is that which would be called astonishingly low. This is nothing peculiar to Chicago or to this one plant.

In flatly refusing to worry along with the calamity howlers about industry becoming more moronic with each mechanical advance, one should not lose sight of the vital fact that many are at work too low in the hierarchy of intelligence for them, or that there are thousands of morons roaming the streets of our cities who can be of use to industry, and to whom industry should be of some use.

WHAT IS INTELLIGENCE?

The easiest, and possibly the most exact, way of defining intelligence is to say it is that which is measured by any of a hundred intelligence tests now in use. Some call it ability to profit by past experience. Others emphasize speed and accuracy of learning. Still others give its primary characteristic as thinking ability.

The man-in-the-street, as usual, probably comes closest to a correct definition when he says it is "the relative amount of dumbness a person possesses."

Intelligence is distinct from knowledge. The greenhorn may not have a great amount of knowledge, but may be able to learn rapidly, to think well, to profit by his experiences, and in six months be as *blasé* as any of his new-found associates in the great city. Or the greenhorn may also be dumb, in which case it is always expected that he will be a source of amusement to his associates and consternation to his friends. This explains why some of the newly rich are never able to crash society's gate.

The size of one's hat does not indicate his brain power. Neither does a high forehead or baldness. The amount of education one has been able to absorb is a rough indicator of his intelligence,

although finishing schools and private tutors are able to produce a veneer of learning which some mistake for intelligence.

Thousands of cases which have been studied indicate rather conclusively that intelligence, or whatever it is that is measured by so-called intelligence tests, cannot be improved. It seems to be rather definitely fixed by the time the child enters the public school. There is also agreement that it is probably inborn, but this does not mean that it is the same as the intelligence of the father or the mother.

Psychologists feel that intelligence is a biological quality in part because it is distributed according to the normal distribution curve. For each genius, for instance, there is an imbecile or idiot. For each person of superior intelligence, there is one high-grade moron.

Industry is not interested so much in the question, "What is intelligence?" as it is in the question, "What can intelligence do?" To this we return shortly.

HOW INTELLIGENCE IS MEASURED

Temperature is not measured directly, but by its effects upon a column of mercury. Intelligence is also measured in an indirect way, although there has been no single and simple measure. No "expansion of mercury" has been discovered by which to measure it.

A variety of objective and reliable tests, which probe primarily the so-called higher mental abilities, are combined to form a test of intelligence. Memory, reasoning, attention, imagination, and ability to use elementary school information as an adult are combined in most tests.

Some tests are designed to be given individually. The industrial cost of these would be prohibitive. Group tests which a regiment of men can take simultaneously under one tester but which are practically as valid have more industrial usefulness.

The first scores on two different intelligence tests cannot be compared with fairness. The scores should be reduced to a common denominator. This common demoninator is usually the average age of children who make a similar score on the test. This, roughly, is known as "mental age."

The term "mental age" has to be interpreted almost as frequently as "Asbestos" on the theater curtain has to be interpreted for the country cousins. It certainly takes an expert interpreter

to salve the wrath of the forty-year-old man who is told his mental age is equal to that of the average fourteen-year-old child. Even that mental age score is above the average of the general population, but it is not going to help matters along by informing the testee that facts indicate that after about 18 years of age intelligence itself grows but little, while the knowledge for the

FIG. 152.—Applicants with Chicago Yellow Cab Company take an intelligence test devised by Dr. A. J. Snow.

intelligence to use accumulates in greater amounts each year. This results in a forty-year-old man with an intelligence equal to that of the fourteen-year-old high-school boy having a greater *effective intelligence,* in some cases! How effective his fourteen-year mental age is depends upon how well he has stored up information with which to use it.

With children under 12 years of age the ratio of their actual mental age to their birthday age yields the Intelligence Quotient, or I.Q. As yet there is no agreement regarding the birthday age

to use in computing the I.Q. of an adult. For all practical industrial purposes, the raw score with a table for interpreting this in terms of mental age is all that is needed.

This section must not be passed over without emphasizing the foolhardiness of a policy of telling applicants or workers their scores on intelligence tests. The score should be interpreted for them in occupational terms and not mathematically. They should be told simply that "the test indicates that you shouldn't waste your time trying to be a doctor or a bank clerk. Those aren't the jobs you could earn most in. You should develop into an *expert* bench mechanic, a *real workman!*"

INTELLIGENCE AND SUCCESS

In any plant there is a close correlation between the size of the wage envelope and the size of intelligence scores. The exceptions to this rule reflect the importance of having tests on something besides intelligence to give a well-rounded and useful testing program. No other single test, however, or anything else, correlates so well with earnings.

There are probably several dozen different jobs that an applicant with an intelligence score of x could do. Of the 170,000 or more specialized tasks in our present industrial organization only a mere handful have had intelligence averages determined. A list of these, as prepared by Douglas Fryer, follows:

A mental age of 18.5 years or more for:
- Accountant
- Business executive
- College teacher
- Editor
- Lawyer
- Engineer (mechanical, electrical, civil)

A mental age of 16 to 18.4 years for:
- Business man
- Buyer
- Chemist
- Correspondent
- Dentist
- Draftsman
- Elementary-school teacher
- Factory superintendent
- Insurance salesman
- Journalist

Minor business executive
Office manager
Physician
Private secretary

A mental age of 15 to 15.9 years for:
Bank clerk
Bookkeeper
Construction foreman
Dictating machine operator
Factory foreman
File clerk
Nurse
Office clerk
Photographer
Postal clerk
Radio operator
Railroad clerk
Shipping clerk
Sign letterer
Stenographer
Stock clerk
Traffic clerk
Telegrapher
Typist
Wholesale salesman

A mental age of 13.6 to 15 years for:
Auto assembler
Auto mechanic
Barber
Bricklayer
Butcher
Carpenter
Caterer
Chauffeur
Concrete worker
Dressmaker
Engineman
Farmer
General blacksmith
General mechanic
Gunsmith
Handy man
Horse trainer
Lathe hand (production)
Laundryman
Lineman
Machinist
Milliner
Motorman

Painter
Pipefitter
Plumber
Policeman
Printer
Riveter
Sales clerk
Stock checker
Teamster
Telephone operator
Vaudeville actor
Waiter

A mental age of 11.5 to 13.5 years for:
Canvas worker
Construction worker
Domestic servant
Factory worker
Fireman (stationary)
Leather worker
Lumberman
Mason
Porter
Sailor
Shoemaker
Sheet metal worker
Structural steel worker
Textile worker
Watchman

A mental age of 10 to 11.4 years for:
Fisherman
Lifter
Loader
Unskilled labor

WHERE TESTS AND COMMON SENSE OVERLAP

Can it be possible that typists have an average mental age of only 15 to 15.9 years! Still, that is considerably above the average mental age of the general population. Not all typists, however, do have that mental age, for some of them become private secretaries (see the table). The private secretary in a sense is an executive typist, and a higher mental age is demanded for the added responsibilities.

The printer, also, may become proprietor of his own business, but to be successful the table shows that his intelligence average must have been above the average of printers. He has ceased being a printer and has become a business man.

NORMS FOR MORGAN'S MENTAL TEST

Form B

1. Administration.—Distribute the test with front page up. Have information properly entered on front page. Read instructions aloud while subjects follow silently. Collect papers at the end of 30 minutes. The only supervision necessary is to see that there is no communication. The test is as easily given to one person as to a large group.

2. Scoring.—Cut two accompanying sheets into strips and score by placing them on the test page; the answer for each question will then appear beside that question. The number with each question as it appears on the scoring key indicates the number of points given for a correct answer to that question. Credit only if entire question is answered correctly. There are no partial credits. The credits may be summarized as follows:

Questions 1 to 15 inclusive receive 1 point each.	15 points possible.
Questions 16 to 36 inclusive receive 2 points each.	42 points possible.
Questions 37 to 57 inclusive receive 3 points each.	63 points possible.
Questions 58 to 67 inclusive receive 4 points each.	40 points possible.
Questions 68 to 74 inclusive receive 5 points each.	30 points possible.
Total possible points	190

3. Norms.

SCORE	AGE	SCORE	AGE
10–14	7.8	80– 84	14.0
15–19	8.2	85– 89	14.6
20–24	8.5	90– 94	15.1
25–29	8.8	95– 99	15.7
30–34	9.2	100–104	16.2
35–39	9.5	105–109	16.8
40–44	9.8	110–114	17.3
45–49	10.2	115–119	17.9
50–54	10.7	120–124	18.4
55–59	11.3	125–129	19.
60–64	11.8	130–134	
65–69	12.4	135–139	
70–74	12.9	140–144	
75–79	13.5	145–149	

FIG. 153.—A self-administering intelligence test is given on the following thirteen pages. General instructions are given above.

MORGAN'S MENTAL TEST

Form B

BY

DR. JOHN J. B. MORGAN
Northwestern University

Do Not Begin Until Told to Do So

A. Write your last name here:.....

B. Write your first name here:.....

C. How old are you?.....

D. What grade have you reached in school?.....

E. How many years have you attended school?.....

Read this:

In this test you will be told to do a number of different things. Some will be very easy and some will be hard. Read every word and do just what it tells you to do. You will have 30 minutes to do the whole test. This will not be time enough to do them all; but you will be marked off for those you do not do, so do as many as you can. Try each one in order in which they are numbered, but if you find one you cannot do, pass on to the next. Do not ask questions.

Time is counted from the time the signal is given to turn the page.

Score.....

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THE CLIO PRESS
Iowa City, Iowa

Copyright, 1923

1. Put on the blank lines the two numbers that should come next: 2 3 4 5 6 7 . . . . The two numbers are 8 and 9. Put 8 on the first blank and 9 on the second.	1
2. Put one word on the blank line to make a good sentence: The grass . . . . . green. Be sure to write "is" in the blank space. The sentence will then read: "The grass is green."	2
3. Put one word in the blank space to make a good sentence: We are going . . . . . school.	3
4. Put the right word on the blank line: DAY is to NIGHT as WHITE is to . . . . . . You should write BLACK on the blank line because BLACK is the opposite of WHITE just as NIGHT is the opposite of DAY.	4
5. Put on the blank lines the two numbers that should come next: 15 20 25 30 35 40	5
6. Put a cross (X) before the best answer to this question: Why are shoes made of leather? . . . . . Because leather is tanned. . . . . . Leather wears well and is warm. . . . . . Because leather can be blackened. Shoes are made of leather because leather wears well and is warm; so be sure to put a cross before the second answer. Make no mark before the others.	6
7. Put the right word on the blank line: MAN is to BOY as CAT is to . . . . . . You should write KITTEN on the blank line because KITTEN is a young CAT just as BOY is a young MAN.	7
8. If you bought 4 cents worth of candy and gave the man 15 cents, how much change would you get? Answer:	8

9. Put a cross before the best answer to this question: 9
Why does it pay to go to school?
.....It makes a man more useful and happy.
.....It makes work for teachers.
.....It makes a lot of work to build the school buildings.

10. Put on the blank lines the two numbers that should come next: 2 4 6 8 10 12 10

11. What 2 coins add up to 10 cents? 11
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies
Two nickels are the only 2 coins that will make 10 cents; so put 2 before "Nickels." Put nothing in the other spaces.

12. Put one word in each blank to make a good sentence: The stars ..... brightly at 12

13. Put a cross (X) before the most important difference: 13
The most important difference between IRON and COAL is that:
.....Coal will burn more easily than iron.
.....Coal is blacker than iron.
.....Iron has to be extracted from ore.
You should put a cross before the first difference. While coal is blacker than iron and while iron has to be extracted from the ore and coal does not, the MOST IMPORTANT difference is that coal will burn more easily than iron.

14. Put the right word on the blank line: 14
HAT is to HEAD as SHOE is to .....

15. Put a cross (X) before the most important difference: 15
The most important difference between a FISH and a CAT is:
.....A fish's ears are smaller than a cat's.
.....A fish's tail is shorter and flatter than a cat's.
.....A fish lives in the water while a cat lives on land.

FIG. 153.—(*Continued.*)

16. Put the right word on the blank line:
MOTHER is to DAUGHTER as FATHER is to 16

17. Put one word in each blank space to make a good sentence.
The poor baby ..... as if it were ..... sick. 17

18. Put a cross (X) before the best answer to this question:
Why is a train harder to stop than an auto? 18
.....It is longer.
.....It is heavier.
.....The brakes are not so good.

19. What 6 coins add up to 10 cents? 19
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.
Five pennies and one nickel add up to 10 cents. No other six coins will make 10 cents; so put a 1 before "Nickels" and a 5 before "Pennies."

20. Make a cross (X) before the most important difference:
The most important difference between a CHAIR and a BED is: 20
.....A bed has bigger legs.
.....More chairs than beds are needed in a house.
.....A bed is to sleep on, a chair to sit on.

21. Divide: 8)5784
Answer: 21

22. Put the right word on the blank line:
TOP is to BOTTOM as ABOVE is to 22

23. Put a cross (X) before the best answer to this question: 23
Why are doctors useful?
.....They cure diseases.
.....They furnish people with pills.
.....They will get up at all hours of the night.

24. Multiply: 6259 ×8 = 24
Answer: .....

25. Put the right word on the blank line: 25
HATE is to ENEMY as LOVE is to .....

26. Make a cross before the most important difference: 26
The most important difference between WATER and MILK is:
.....Babies drink more milk than water.
.....Milk is whiter than water.
.....Milk comes from animals, water from the clouds.

27. Put a cross before the most important difference: 27
The most important difference between GLASS and WOOD is:
.....Glass is more expensive than wood.
.....Glass is thinner than wood.
.....Glass lets through more light than wood.

28. Put the right word on the blank line: 28
TREE is to BRANCH as MAN is to .....

29. If Bill is lighter than Tom, and Tom is lighter than Jack: 29
Is Jack heavier or lighter than Bill? Answer.....
Is Tom heavier or lighter than Bill? Answer.....
Is Bill heavier or lighter than Jack? Answer.....

FIG. 153.—(*Continued.*)

30. Put the right word on the blank line: FLY is to AIR as SWIM is to	30
31. I have 5 cigars and Joe has 7 cigars. Tom comes along and we see that he has not any. We want all three of us to have the same number. If I give Tom 1 cigar, how many must Joe give him so that all three of us have the same number? Answer.....	31
32. Make a cross before the most important difference: The most important difference between CLOTH and PAPER is: .....Paper will tear more easily than cloth. .....Paper is whiter than cloth. .....Cloth has a rougher surface than paper.	32
33. Put one word in each blank space to make a good sentence: The boy who ..... hard will	33
34. Write on the blank lines the two numbers that should come next: 2 4 8 16 32 64	34
35. Put the right word on the blank line: PENNY is to DIME as DIME is to	35
36. What 3 coins add up to 40 cents? .....Halves .....Quarters .....Dimes .....Nickels .....Pennies.	36
37. Put one word in each blank space to make a good sentence: One's real ..... appears ..... often in his ..... than in his speech.	37
38. What 5 coins add up to 80 cents? .....Halves .....Quarters .....Dimes .....Nickels .....Pennies.	38
39. Put one word in each blank space to make a good sentence: The sun is so ....., that one can not ..... directly ..... causing great discomfort to the eyes.	39

40. What 5 coins add up to 35 cents? 40
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

41. Write on the blank lines the two numbers that should come next: 15 16 14 17 13 18 41

42. What 5 coins add up to 91 cents? 42
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

43. Put the right word on the blank line: 43
MINUTE is to HOUR as SECOND is to .....

44. What 6 coins add up to 40 cents? 44
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

45. Put one word in each blank space to make a good sentence: 45
It is very ..... to become ..... acquainted ..... persons who are ..... timid.

46. What 5 coins add up to 71 cents? 46
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

47. Make a cross before the most important difference: 47
The most important difference between IRON and STEEL is:
.....Iron does not rust as quickly as steel.
.....Iron is softer than steel.
.....Steel takes a brighter polish than iron.

48. What 8 coins add up to 35 cents? 48
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

49. Put one word in each blank space to make a good sentence: 49
.....are times in the ..... of almost ..... of us when we ..... for a long life.

50. What 6 coins add up to 97 cents? 50
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

FIG. 153.—(*Continued.*)

51. Suppose the clock says it is now seventeen minutes after five. Now, suppose the two hands of the clock were to trade places, so that the large hand takes the place where the small hand was, and the small hand takes the place where the large hand was, what time would the clock then say? 51

Answer: .....

52. What 7 coins add up to 73 cents? 52

.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

53. Suppose the clock says it is now eighteen minutes after eight. Now, suppose the two hands of the clock were to trade places so that the large hand takes the place where the small hand was, and the small hand takes the place where the large hand was; what time would the clock then say? 53

Answer: .....

54. What 5 coins add up to 51 cents? 54

.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

55. Five men are climbing a mountain and have reached different levels. If Bill is above Tom, Joe is below Tom, Bill is below Sam, and Tom is the same height as Paul: 55

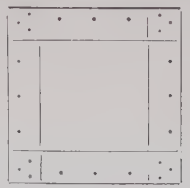
Is Joe above or below Bill? Answer:.....
Is Joe above or below Sam? Answer:.....
Is Paul above or below Bill? Answer:.....
Is Paul above or below Joe? Answer:.....

56. What 6 coins add up to 66 cents? 56

.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

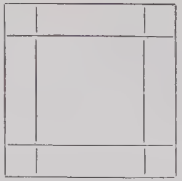
57. Write on the lines the two numbers that should come next: 3 4 6 9 13 18 57

58. Suppose you had 24 pebbles placed as follows, each dot representing a pebble: 58

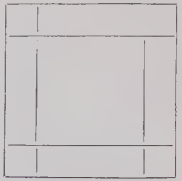


The total number of pebbles included in the entire border along one side, counting both corners in each side, would be 9.

Indicate by dots in the figure to the right how you would arrange the same 24 pebbles so as to have 7 pebbles on each of the 4 sides.



Indicate by dots in the figure to the right how you would arrange the same 24 pebbles so as to have 11 pebbles on each of the 4 sides.



59. Suppose the clock says it is now eight minutes before five. Now, suppose the two hands of the clock were to trade places so that the large hand takes the place where the small hand was, and the small hand takes the place where the large hand was; what time would the clock then say? 59
Answer: .....

60. What 7 coins add up to 97 cents? 60
.....Halves .....Quarters .....Dimes .....Nickels .....Pennies.

61. Put one word in each blank space to make a good sentence: 61
The knowledge of .... use fire is ..... of ..... important things known by ..... but unknown ..... animals.

FIG. 153.—(*Continued.*)

62. If: Carl is poorer than Fred,
Abe is poorer than Dan,
Fred is just as rich as Abe,
Ben is poorer than Carl, and
Jack is richer than Dan. 62

Is Dan richer or poorer than Ben? Answer.....
Is Ben richer or poorer than Jack? Answer.....
Is Abe richer or poorer than Ben? Answer.....
Is Carl richer or poorer than Dan? Answer.....

63. Write on the blank lines the two numbers that should come next: 21 18 16 13 11 8 63

64. Write on the blank lines the two numbers that should come next: 16 8 4 2 1 ½ 64

65. Put one word in each blank to make a good sentence: 65
To ..... friends is always ..... the ..... it takes.

66. Put on the blank lines the two numbers that should come next: 2 4 6 12 14 28 66

67. A man went to a farmer to buy 5 pints of milk. The farmer had nothing but a 9 pint pail and a 4 pint pail with which to measure. Without guessing he succeeded in measuring out exactly 5 pints of milk with these pails. Make a 1 before the first thing he did, make a 2 before the second thing he did, and make a 3 before the last thing he did, in order to measure out the 5 pints. 67

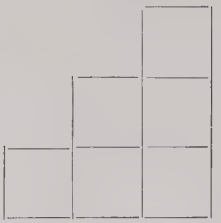
.....Emptied the 4 pint pail.
.....Filled the 9 pint pail.
.....Filled the 4 pint pail from the 9 pint pail.

68. Suppose you had seven match sticks placed this way: 68

You would have two squares.

Now, if you picked up the three marked with a cross, you would have one square left and no extra matches.

Suppose you had eighteen matches placed this way:



Cross out the TWO matches that you would pick up so as to leave just FOUR squares and leave no extra matches.

69. A man went to a farmer to buy 4 pints of milk. The farmer had nothing but a 6 pint pail and an 8 pint pail with which to measure. Without guessing at the amount he succeeded in measuring out exactly 4 pints of milk with these two pails. Below are listed the different things he did. Mark them from 1 to 5 in order in which he did them. 69

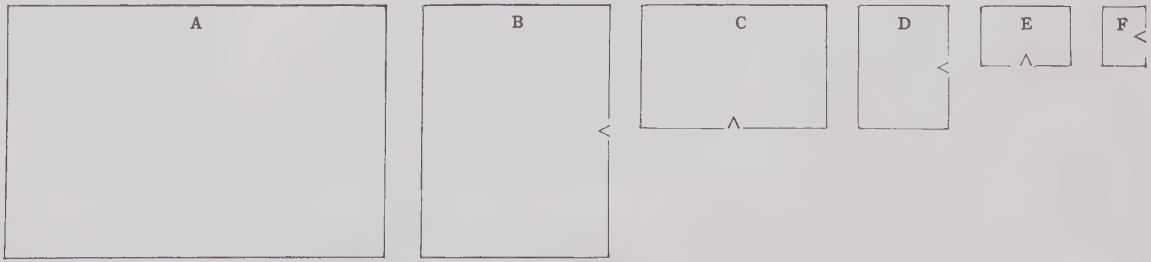
. . . . . Filled the 8 pint pail from the 6 pint pail.
. . . . . Filled the 6 pint pail.
. . . . . Emptied the 8 pint pail.
. . . . . Filled the 6 pint pail.
. . . . . Emptied the 6 pint pail into the 8 pint pail.

70. A man went to a farmer to buy 4 pints of milk. The farmer had nothing but a 7 pint pail and a 5 pint pail with which to measure. Without guessing at the amount he succeeded in measuring out exactly 4 pints of milk with these two pails. Below are listed the different things he did. Mark them from 1 to 7 in order in which he did them. 70

FIG. 153.—(*Continued.*)

.....Emptied the 5 pint pail.
.....Filled the 5 pint pail from the 7 pint pail.
.....Emptied the 7 pint pail into the 5 pint pail.
.....Filled the 5 pint pail from the 7 pint pail.
.....Filled the 7 pint pail.
.....Emptied the 5 pint pail.
.....Filled the 7 pint pail.

71. Suppose you had a sheet of paper as shown at A. If you folded it once you would have two thicknesses of paper as shown at B. Suppose you folded the double sheet to the size shown at C. Now, suppose you should cut a notch into the folded side of C as shown in the figure. Draw in A the holes that would appear when the sheet is unfolded. 71



If you cut a notch in the folded side with 1 fold (as in B), how many holes would you have in the sheet after it is opened? Answer:.....

If you cut a notch in the folded side with 2 folds (as in C), how many holes would you have in the sheet after it is opened? Answer:.....

If you cut a notch in the folded side with 3 folds (as in D), how many holes would you have in the sheet after it is opened? Answer:.....

If you cut a notch in the folded side with 4 folds (as in E), how many holes would you have in the sheet after it is opened? Answer:.....

If you cut a notch in the folded side with 5 folds (as in F), how many holes would you have in the sheet after it is opened? Answer:.....

72. A one-track railroad has a switch which will hold 25 cars and an engine. This switch is connected at each end with the main track. Two 50-car trains (A and B), each having but one engine, meet and must pass at this switch. Mark in order from 1 to 9 the steps that would have to be taken to pass the trains. 72

.....Engine B couples with second half of train A.
.....Engine B uncouples from the second half of train A and backs out of the switch.
.....Train A divides into two halves.
.....Engine B backs train B over the switch until it has placed the second half of train A on the switch.
.....Engine A pulls the first section of train A off the switch on to the main track.
.....Engine A backs the first section of train A and couples with the second section of train A.
.....Engine A pulls the first section of train A on to the switch.
.....Train B running on the main track passes the engine and first section of train A.
.....Engine B pulls train B past the second section of train A.

73. Two men find in a cellar an eight-gallon cask full of wine. They also find an empty five-gallon cask and an empty three-gallon cask. They wish to measure out two lots of exactly four gallons each. This can be accomplished if the following seven moves are executed in the correct order. Indicate by the numbers 1, 2, 3, etc., the order in which these moves should be executed. 73

.....Fill the 3 gallon cask from the 5 gallon cask.
.....Empty the 3 gallon cask into the 8 gallon cask.
.....Fill the 5 gallon cask from the 8 gallon cask.
.....Empty the 3 gallon cask into the 8 gallon cask.
.....Fill the 5 gallon cask from the 8 gallon cask.
.....Empty the 5 gallon cask into the 3 gallon cask.
.....Fill the 3 gallon cask from the 5 gallon cask.

FIG. 153.—(*Continued.*)

COMMON-SENSE JUDGMENTS OF INTELLIGENCE

Whether it is feasible to use intelligence tests or not, the interviewer should give special attention to making a sound estimate of the probable intelligence of the applicant with whom he is talking. His clothing, his facial expressions, or the size of his forehead do not betray his intelligence. The following tendencies are useful and fairly valid in making an estimate of the applicant's general intelligence:

An applicant under forty who has finished only a few years of the public schools may justly be judged to be low in intelligence. This arbitrary age limit is specified since public education has not been open to some above this age. As a rule, the more education a person has had, the higher his intelligence. Obviously, however, injustice is going to be done to some applicants if this is the sole basis of the estimate.

The occupation of the applicant's parents and relatives indicates his probable intelligence in this way: Low intelligence is characteristic of unskilled workers, average intelligence of skilled and semi-skilled workers, high intelligence of business and professional people and of executives. Since intelligence generally runs in the family, the family occupations give a rough index of the applicant's intelligence status.

Intelligence and social status are closely related. The applicant who lives in a section characterized by its low social level is probably less intelligent than the applicant from the other side of the tracks.

In the case of married applicants, the progress of their children in school is an indicator of the approximate intelligence of the applicant.

The previous occupations of the applicant also throw some light on his intelligence level, especially those high in the scale which he has followed only a short time.

The small talk of the applicant is a useful, but more crude, indicator of his intelligence. This conversation reflects his rahge of information and knowledge of words. The wider the ranges of these, the greater the intelligence, as a rule. A great amount of talk or an argumentative tendency should not be confused with intelligence.

CHAPTER XVII

EMOTIONAL MAKE-UP AND JOB ADJUSTMENT

I called at an office to renew an old acquaintance a short time ago. While waiting in the reception room, I noticed that the secretary greeted each visitor with marked lack of interest. She made a very poor contact for the firm, in contrast with the comfortable furnishings of the room. I mentioned this to my friend. After some thought he told me he could recall that since

FIG. 154.—An emotional test by Dr. A. J. Snow for the Chicago Yellow Cab Company, records the applicant's reactions when unexpected emotional situations are produced.

this new secretary had been on duty in the reception room he had noticed each caller seemed to be mildly antagonistic.

He tried the experiment of placing a general clerk who liked meeting people in the reception room, and has written me that the change in the attitude of visitors is so noticeable that he is "almost inclined to believe in this psychology stuff."

Experiments are indicating that the most serviceable classification of personality is one discovered by psychoanalysts, particularly Carl G. Jung of Zurich, Switzerland. Diseased personalities indicated to Dr. Jung that humans could be separated into two rough classes, introverts and extroverts. Introverts are characterized by their emotional outlets being expressed largely within themselves; that is, their emotions are introverted. Day dreaming is an instance where the emotional outlets are introverted.

The extroverts, in contrast, express their emotional outlets in action and association with others. They might be called men of action while the introverts are men of thought.

An outburst of temper is an emotional outlet. So is blushing, laughter, likes and dislikes, wanting to be alone, preference for various kinds of amusements, and in some cases the occupation one enters. All these afford emotional outlets. In some instances, however, an occupation is entered which cannot provide emotional outlets, resulting in dissatisfaction, turnover, fault-finding, and poor work. In such a case some recreations may be found which will provide outlets for the individual's own make-up, thus giving him greater expression of his real nature and possibly giving him self-realization.

Theodore Roosevelt, Sr., is usually considered extrovert, Woodrow Wilson introvert. It is possible that their divergent political policies can be explained on this basis.

HOW TO TELL AN INTROVERT OR EXTROVERT

Personality signs revealed in actions:

1. The introvert blushes easily; the extrovert rarely blushes.
2. The extrovert laughs more readily than the introvert.
3. The introvert is usually outspoken; the extrovert is usually careful not to hurt the feelings of others.
4. The extrovert is a fluent talker; the introvert can prepare a report in writing easier than he can tell it in conversation.
5. The extrovert loans money and possessions more readily than the introvert.
6. The extrovert moves faster than the introvert in the routine actions of the day, such as walking, dressing, talking, etc.
7. The extrovert does not take particular care of his personal property, such as watches, clothes, etc.; the introvert is found continually oiling, polishing, and tinkering.
8. Introverts are usually reluctant about making friends with the opposite sex, while extroverts are attracted by them.

9. Introverts are easily embarrassed by having to be in front of a crowd.

10. The extrovert is a more natural public speaker.

11. The introvert likes to argue.

12. The introvert is slow about making friends.

13. The introvert rewrites his letters, inserts interlineations, adds a postscript, and corrects every mistake of the typist.

Personality signs revealed in thinking and attitudes are:

1. The introvert worries; the extrovert has scarcely a care in the world.

2. The feelings of the introvert are easily hurt; the extrovert is not bothered by what is said about him.

3. The introvert deliberates in great detail about everything—what to wear, where to eat, etc., and usually tells one why he decided to do what he did.

4. The introvert rebels when ordered to do a thing; the extrovert accepts directions as a matter of course.

5. The introvert is urged to his best efforts by praise; the extrovert is not affected by praise.

6. The introvert is suspicious of the motives of others.

7. The introvert is usually radical in religion and politics; the extrovert—if he entertains any opinions—is usually conservative.

8. The introvert would rather struggle alone to solve a problem than ask for help.

9. The introvert would rather work alone in a room than with others.

10. Extroverts follow athletics; introverts books and "high-brow" magazines.

11. The introvert is a poor loser.

12. The introvert daydreams a great deal.

13. The introvert prefers fine, delicate work (die making, accounting), while the extrovert prefers work in which details do not bother.

14. The introvert is inclined to be moody at times.

15. The introvert is very conscientious.

A TEST DEVISED

For the past three years the Colgate University Psychological Laboratory has been experimenting with a rating scale designed

Think. Intro.
Act. Intro.
Total Intro.

..... *Person being reported*

..... *Person making report*

Personal Inventory

Revision

C3

Date.....
Place.....

Directions: Describe your subject by answering the questions asked in the large type. Do this by making a check mark through one of the half-inch lines. After reading over the phrases in small type after each question, think back over your subject's life for *the past few months* and determine where the check mark should be made to describe him accurately. Describe his *average behavior and thoughts.*

There is no time limit to this. Read each line entirely before making a check mark. Describe his *average* thoughts and behavior for *the past few months only.* Check only one of the half-inch sections in answer to each question.

Make a check mark any place along each dashed line to describe your subject. Consider only how the subject has been the last few months. Read each line through carefully before making a check mark.

1. How steadily has he worked at his job during the day?	continuously until completed	occasional lapse of work	intermittent spurts and lapses	frequent tendency to talk, rest, etc.	stopped with the least excuse
2. How has he considered possible misfortunes?	worried a great deal	sometimes mentioned worries	seemed to suppress worries	rather care-free	not a worry in the world
3. How have his feelings been affected by remarks or actions concerning him?	very easily angered	often aroused	sometimes disturbed	affected in rare instances	unaffected
4. How has he considered the feelings of others?	told truth regardless of feeling	generally outspoken	considerate at times	frank, yet tactful	careful not to hurt others
5. How has he been as a social mixer?	always in the lead	mixes readily	friendly with some	usually retiring	shy and backward
6. How has he been at remembering things to be done?	continually forgetting	occasionally forgetful	forgot minor ones	usually remembered	rarely forgot
7. How has he been in social conversation?	talkative	an easy talker	tended to listen	only answered questions	refrained from talking

Read each line thoroughly before making a check mark. Remember only the past few months is to be considered.

8. Has he usually sought or given reasons for his actions and decisions?	usually went out of way to explain	gave reasons in most cases	explained some significant ones	seldom gave reason	acted impulsively
9. How has he been about making loans?	gave to anyone who asked	rarely hesitates to loan		loaned on rare occasions	never loaned
10. How has he taken to discipline and commands?	obeys unquestioningly	usually obeys willingly	obeys with deliberation	sulked, but obeyed	ignores when possible
11. How has he responded to praise?	did not work so well	worked same as usual	sometimes worked better	usually improved in work	generally worked better
12. How would you describe his actions in general?	generally slow and deliberate	seldom in a hurry	wastes no time	usually rapid	impulsive or quick

Make a check mark any place along each dashed line to describe your subject. Consider only how the subject has been during the last few months.
Read each line through carefully before making a check mark.

13. Does he seem to be suspicious of others?	very suspicious	inclined to question actions	tries to unmask important motives	takes interest in others' actions	unconcerned with others
14. How has he talked when with others?	replied only when spoken to	appeared to think more than talk	talked when interested	fluent talker	talked a great deal
15. What is his reaction to questions of politics, religion, social change, etc?	urges some radical changes	thinks many changes needed	has little to say on subject	advocates conservative ideas	very conservative
16. Is he generally inclined to work things out alone?	always works unaided	very rarely asks for aid	sometime sought assistance	did not hesitate to ask for aid	got aid very often
17. How has he been about dress and personal appearance?	does not seem to care about fashion	appears to dress for comfort	is neat dresser	close attention to dress	dresses in extreme style
18. What care has he taken of tools, personal belongings, etc?	very careful to have them repaired	watches only best ones	gives little time to their care	neglectful at times	very neglectful generally
19. How have his likes in athletics and intellectual things compared?	likes athletics best	mostly athletic	gives mutual attention to both	mostly reads books in spare time	likes intellectual topics
20. How has failure affected his actions?	always gloomy and sad	often gloomy	sometimes dull and gloomy	seldom gloomy or sad	not affected at all

21. How has he been about telling his worries and troubles?	seems to tell all his troubles	often tells worries	once in a while he talks of trouble	seldom speaks of worries	uncommunicative
22. How has he made friends with the opposite sex?	avoids them	seems uncomfortable with them	does not seek them	happy when with them	always seeks their company
23. How has he acted in dangerous and embarrassing situations?	cool and self-possessed	uses head to advantage	seems to labor for coolness	nervous and uncertain	loses head completely

Make a check mark any place along each dashed line to describe your subject. Consider only how the subject has been the last few months. Read each line through carefully before making a check mark.

24. How has he acted when physical courage was needed?	reckless and impulsive	calm but strong	nervous yet unflinching	tries to avoid if possible	shuns all danger
25. How has he responded to the sufferings of others?	readily moved to tears	sympathetic and kindly	seems blue when others suffer	sad only when near friends are in pain	unmoved by others suffering
26. How has he acted in front of a crowd of strangers?	awkward and embarrassed	slightly nervous	neglected them most of the time	worked on unperturbed	seemed to ignore them
27. Has he found it easy to speak in public?	seeks opportunity to speak	speaks whenever possible	nervous and hesitant	cannot express self in public	avoids it

Read each line through before making a check mark. Remember only the past few months is to be considered.

28. How has he been when mental courage was needed?	cool, calm, and steady	reliable	uncertain yet determined to do his share	nervous and unreliable	breaks down completely
29. How has he been at selling things?	very poor salesman	dislikes selling	sells when necessary	sells when given the opportunity	always selling things
30. What sort of work has he been best at?	coarse, rough work	avoided tedious work		painstaking	exact and delicate
31. How has he been about arguing?	looks for chance	defends own opinions	argues when forced to	dropped argument quickly	avoided all arguments
32. How has he compared with his chosen associates intellectually?	much superior	a little above	about equal	a little below	much inferior
33. How has he been about making friends?	very cautious	must know a long time	somewhat careful in his choice	makes them readily	makes friends with everyone

Make a check mark any place along each dashed line to describe your subject. Consider only how the subject has been during the last few months.

Read each line through carefully before making a check mark.

34. How does he compare physically with his chosen associates?	much superior	a little better	about equal	a little below average	much inferior
35. How have his moods changed without apparent cause?	often from gloomy to hilarious	somewhat changeable		kept in fairly uniform spirits	moods always the same
36. How have his moods changed with cause?	responded quickly	susceptable to change	must be adequate reason	seldom changes	nothing changes him
37. How high a value does he place upon his own abilities?	underestimates self	very modest value	confident in self	great confidence in own ability	quite conceited
38. How has he been about blushing?	readily, at slight cause	blushed readily	once in a while	on rare occasions	never blushes

Read each line through before making a check mark. Remember only the past few months is to be considered.

39. Has he expressed himself better in speaking or in writing?	best in writing	preferred writing	in both equally	preferred speaking	best in talk
40. What has he done when things went wrong?	bewails troubles	worrys over them (moody)	tries to rectify them	gives them only momentary thought	do not bother him
41. How has he been about sharing things with others?	very rarely does	has, but reluctantly	to friends only	rarely hesitates	does on every occasion

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to measure introversion-extroversion. Something over 30,000 hours has been spent on this development.

More than a hundred alleged traits of these personality types have been studied experimentally and forty-one retained as valid indicators. These are included in *Personal Inventory, Revision C3*. This is reproduced in full on pages 306 to 309.

The person being studied is described on this form by someone who knows him. The office manager, for instance, describes his clerks, the works manager describes his foremen, the foremen describe bench mechanics.

One end of the rating line for each question indicates an introvert tendency, the other end indicates an extrovert tendency. The introvert end is to the left on some questions; on others it is to the right. This shifting has been done to offset any prejudice and to give added reliability to the ratings.

HOW IT IS SCORED

Several thousand descriptions for each question have been compiled on a master sheet. The quarter of these at the introvert end have been taken to indicate introversion in the particular trait. In other words, this section of the rating line shows that the individual is more introvert than three-fourths of the general population.

After the subject being studied is described, each of the questions is scored with the aid of a transparent stencil which marks the introvert quarters. Each description which falls in this section is marked with a colored pencil as being an introvert sign. The total of these colored marks gives the raw score.

The sections of each rating line which indicate the trait of introversion are as follows:

Question	
1. Last four lines.	11. Last four lines.
2. First three lines.	12. First three lines.
3. First four lines.	13. First four lines.
4. First four lines.	14. First four lines.
5. Last five lines.	15. First four lines.
6. First four lines.	16. First three lines.
7. Last six lines.	17. Last five lines.
8. First four lines.	18. First two lines.
9. Last four lines.	19. Last five lines.
10. Last four lines.	20. First five lines.

21. Last four lines.
22. First five lines.
23. Last five lines.
24. Last five lines.
25. First four lines.
26. First four lines.
27. Last five lines.
28. Last six lines.
29. First three lines.
30. Last four lines.
31. First two lines.
32. First four lines.
33. First five lines.
34. First four lines.
35. First four lines.
36. First four lines.
37. Last four lines.
38. First four lines.
39. First four lines.
40. First four lines.
41. First four lines.

About 15 minutes are required to fill out a description. The scoring requires less than a minute.

Two other methods of scoring have been experimented with: (1) The extrovert ends of the questions have been scored. This gives a negative correlation of 0.92 with the score obtained from the other end of the ratings. This indicates that a low introversion score means high extroversion. For all practical purposes it does not matter which end is scored. (2) Each rating was divided into fifths and a score of 1, 2, 3, 4, or 5 assigned to the rating. This was found to correlate 0.88 with the scoring when only the introvert quarter was scored. Again, for practical purposes, the simpler scoring as outlined above is valid.

IS THE TEST RELIABLE?

Ratings and descriptions of others, at best, are beset with error and prejudice. Special attention has been given to overcoming this in these personal inventories. Each question has been kept free of censor or moral implication. So far as possible objective traits to be described rather than subjective judgments of the individual have been attempted. Some of the original hundred questions have been eliminated because, while significant, they were found to be unreliable.

A perfectly reliable rating would give the same score for John Smith regardless of who rated him. It would also give the same score if he, having been rated a month ago, were rated again today without the aid of the earlier description of him.

It has been found that the descriptions of one person by several of his casual acquaintances correlate 0.85. Two descriptions of one person by a rater, who in the meantime has rated several others, correlate 0.90. These indicate a satisfactory reliability.

The ideal, of course, is to discover some test which will have the objectivity and precision of a micrometer.

WHAT A SCORE MEANS

A raw score in itself means little. When compared with the scores of others, however, it gains meaning by showing that the individual has a higher or lower score than others. A higher score indicates that he is more introvert than others, a lower score that he is less introvert.

The following table gives a basis for interpreting the scores. The percentile rank reveals that a man with a score of 10 is more introvert than 50 per cent of men. A score of 19 means that he is more introvert than 93 per cent of men.

Since introversion and extroversion are opposites, a score of 19 would also mean that the individual is more extrovert than only 7 per cent of men. The point of reference usually followed, however, is "more introvert than 93 per cent of men."

What a score means in certain occupations will be shown later.

Women almost without exception have higher scores than men, that is, appear to be more introvert. On account of this, two separate percentile ranks are given, one for each sex.

In height it is generally known that women average shorter than men. Yet the same foot rule is used in measuring their height. It does not seem advisable in the present status of the experimentation to compare women with men, but to experiment within the same sex. The average score of men is 10.5, of women 15.5.

ARE THE TYPES DISTINCT?

Great emphasis should be given to the fact that introvert and extrovert traits are found in everyone. The only exceptions occur in cases of mental disorder found in state hospitals, where a patient with dementia praecox may disclose no extrovert signs.

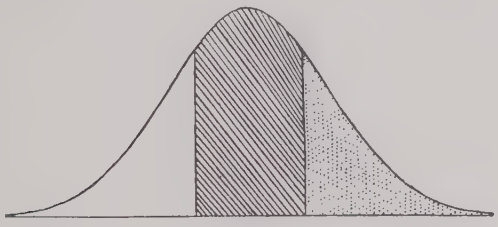
Liking to argue is an introvert trait. But having this trait to a great degree does not necessarily make one introvert. If there is a total of 19 such introvert traits in a man, however, he is more introvert than 93 per cent of men, and he should probably be looked upon as an introvert.

The introvert and extrovert conditions are not distinct. The current use of the terms would indicate that the general popula-

tion would be found divided into two distinct groups, as shown below:

Extrovert Introvert

What is found is the bell-shaped normal distribution below:



Extrovert Ambivert Introvert

This means that introversion converges gradually into extroversion. Most people are in the great converging zone shown by the highest part of the chart above. The name ambivert is generally applied to this middle ground.

INDUSTRIAL APPLICATION

Through the cooperation of the Central New York Section of the Taylor Society, the following industrial data were secured:

Bench mechanics show no distinct grouping at either end of the scale, tending toward ambiversion.

Office clerks are not grouped closely, but are inclined toward introversion.

Foremen and executives whose duties require handling others are distinctly extrovert.

Inspectors, accountants, and research engineers are, in general, introvert.

Promotion.—It would seem advisable to promote extrovert bench mechanics to foremen, not merely the best workers. Inspectors might best be secured from introvert bench mechanics.

Motivation.—Introverts respond favorably to praise. Praise is largely wasted on an extrovert. Athletic activities appeal

more to the extrovert. House organs appeal more to the introvert. Since each industrial organization probably has a normal distribution of introversion-ambiversion-extroversion, a wide range of industrial-relations activities is advisable to appeal to the divergent emotional nature of the workers. When any particular group, such as die makers, is directly concerned, it is well to plan activities largely for introverts.

PERCENTILE RANKS FOR SCORES ON PERSONAL INVENTORY C3
(Introversion—Extroversion)
(Percentiles revised as of Dec. 15, 1926, by Colgate University Psychological Laboratory)

Score	Percentile rank	
	Men	Women
4	1	
5	4	
6	7	
7	14	
8	23	
9	34	
10	45	1
11	58	4
12	70	8
13	77	18
14	85	28
15	90	40
16	94	58
17	96	70
18	99	78
19	99	84
20	99	90
21	99	94
22	99	97
23	99	99

A score of 10 by a man indicates that he is more introvert than 45 per cent of men; the same score by a woman indicates that she is more introvert than only 1 per cent of women.

The higher the score the more introvert the individual.

This is illustrated in the fact that conventions appeal to salesmen, but who ever heard of an inspectors' or die-makers' convention? Educational opportunities, in contrast, are usually seized upon by the introvert rather than the extrovert.

WHICH IS THE IDEAL?

For some unfortunate reason it is common to look upon the introvert as being the less desirable. So far as earnings are concerned it has been found that introvert college graduates earn as much as those who are extrovert.

It is possible that with the increase in precision work in industry the demand for introverts will increase. At present the industrial situation affords opportunities for both extremes. The important thing is for an introvert to be in work which gives him a chance to express his emotional nature. This opinion is reflected in the growing emphasis upon the self-realization of the individual. An extrovert on a bookkeeper's stool would probably not have self-realization. Conversely, the introvert contact man would have to alter his emotional nature a great deal to succeed. Neither could be himself.

Nurses, for instance, are found to be extrovert. Those who are introvert soon leave the training school.

Much of the world's progress in discovery, invention, and research is due principally to the introvert. The ultilization of these advances can justly be credited to extrovertive activity.

Records the laboratory has secured from "top-control" executives in industry indicate a combination of introversion in thinking and extroversion in acting.

FACTS ABOUT INTROVERSION-EXTROVERSION

The exact cause of these personality traits is not known. There is some evidence that they are inherited, other that they are acquired. The Colgate Laboratory is gathering data on this; so far the findings are equivocal.

There is no apparent relationship between either extreme and intelligence among high-school graduates. As data is secured from a wider range of intelligence, however, it is possible that the findings may be different.

There may be a physiological basis for introversion-extroversion if data gathered in the laboratory the past year are confirmed

by 250 cases now under study. The first group of fifty cases studied gave a correlation of 0.60 between introversion-extroversion and the morphologic index.

Racial differences in these emotional traits have been alleged, but are not as yet confirmed by laboratory observations. The Colgate data on several hundred cases have yielded no significant results to date.

There appears to be some relation between age and introversion-extroversion. Youth, in general, is extrovert, old age introvert.

Our data indicate a strong tendency for introverts to get along best with introverts, extroverts best with extroverts. This and the paragraph just above may give some light on the lack of understanding which has always existed between youth and maturity. It may also throw light on divorce. Data on this are being gathered. The indications for industrial relations are obvious.

How introversion or extroversion can be overcome is another unanswered question. I have known of executives who had noticed that some of the introvert traits catalogued above were a handicap in their work and who tried to overcome one a week, with general success. In trying to overcome such emotional traits the rule is to substitute another reaction, not to try to crowd one out of one's personality make-up.

COMMON SENSE IN ESTIMATING PERSONALITY TRAITS

In case formal tests are not used, it is possible to make an estimate of the probable personality make-up of the applicant from "clinical observations" during the interview.

For instance, the extrovert will be more at home than the introvert, will talk easier, will be less suspicious of favoritism to others, less suspicious of unfair treatment in general. The conversation of the extrovert is likely to cover many topics (which should not be confused with intelligence, but considered rather as distractibility). The introvert will not laugh at the interviewer's humorous stories, and will likely blush if an off-color story is told. The introvert will probably become sulky if the interviewer casts reflections upon the applicant's abilities or accomplishments.

The extrovert will probably belong to more social organizations, know more about athletics and less about books and authors,

have less marked opinions about the President of the United States, and be poorer in book learning. The extrovert is apt to pick up conversation with others in the waiting room, or will be reading *Judge* rather than the *Atlantic Monthly.*

George Washington University Series

SOCIAL INTELLIGENCE TEST[1]

Prepared by F. A. Moss, T. Hunt, K. T. Omwake, and G. W. Jex

Name.....

Age.....

Test	Method of Scoring	Score
1	Number right	
2	Number right × 2	
3	Number right × 2	
4	Rights—Wrongs	
5	(Rights—Wrongs) ÷ 2	
6	Number right	
	Total	

[1] Copyright, 1925, by F. A. Moss.

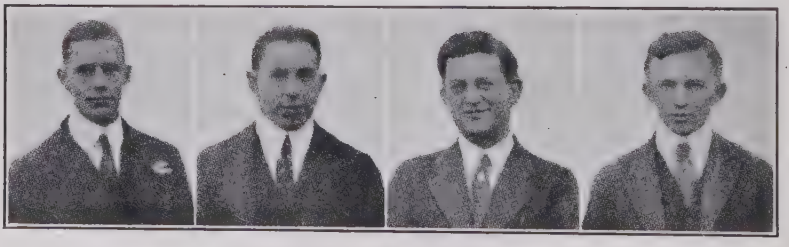
This interesting test is reproduced in full on the following 12 pages. Alternative forms of the test and instructions for scoring and interpreting the results may be obtained from Dr. Moss.

FIRST SHEET—MEMORY FOR NAMES AND FACES

Study each of the twelve faces very carefully and try to remember the name that goes with it, for later you will have to recognize these faces in a larger group and remember their names. You will have 4 minutes to study this sheet.

Howard Jones Mike Bailey Lee Higgins Sid Smith

George Cook Ben Elliott John Moore Chester Sims



Tom Edwards Fritz Wagner Jake McDonald Clifton Clark

Test 1.—Judgment in Social Situations

Directions: For each of the following questions, four answers are suggested. Before each answer are four spaces in which to make a mark. Read over the four answers and then place a cross (X) in the space before the answer which is best or most nearly correct. Do not place a cross before more than one answer under each question; if you do, your work on that question will not be counted. Only one of the four answers is the best one and you are to show by the cross (X) which it is.

1. You have been appointed to a position with a large firm. The best way to establish friendly and pleasant relations with your business associates would be to:

——Avoid noticing and correcting the errors they make.
——Always speak well of them to the boss.
——Be interested and cooperative in your work.
——Ask to be allowed to do those tasks which you can do better than they can.

2. You are dining with a party of friends at a fashionable restaurant and accidentally drop your fork. You should:

——Ask the waiter for another fork.
——Ask the waiter to pick it up.
——Ask one of the gentlemen in your party to pick it up.
——Pick it up and continue your conversation.

3. While burying their Uncle, Ike proposed to four of his cousins that each deposit $20 in their Uncle's casket. When the other four had each dropped in $20 in currency, Ike took the $80 and put in his check for $100. The thing which prompted Ike's conduct was most likely:

——Craftiness.
——Ancestor worship.
——Devotion.
——Superstition.

4. A man sixty years of age who has been a faithful employee in your business for twenty-five years complained that his work was too heavy. It would be best to:

——Tell him to go back to work or you'll fire him.
——Dismiss him and get a younger man in his place.
——Give him a raise in salary so he won't object to the hard work.
——Lighten his work.

5. John does not smoke. He is invited to a smoker. If he accepts the invitation it would be best for him to:

——Try to smoke.
——Refuse politely without comment.
——Apologetically say that he has not yet learned to smoke.
——Explain the injurious effects of smoking.

6. You are entertaining two friends at dinner, one of whom is very conservative and the other radical in her views. A very heated discussion arises as to the relative value of Latin or science as cultural subjects in college. It would be best to:
——Take a definite stand with the one you think is right.
——Try to change the subject of the conversation.
——Enter into the argument and give your point of view, showing where both are too extreme in their views.
——Ask them to change the subject so as to avoid further argument.
7. You are calling on a close friend who has been ill for some time. It would be best to:
——Tell her of the good times you are having.
——Tell her of the doings of a number of mutual friends.
——Discuss her illness.
——Impress upon her how sorry you are that she is ill.
8. You are to be toastmaster at a club dinner on Saturday evening. Saturday morning you find that you will be unable to attend because of illness in your family. You should:
——Make arrangements for cancelling the dinner party.
——Make arrangements for someone to take your place.
——Write out in detail the plans you had for the evening and send them by messenger.
——Send a note to a member of the club explaining your absence.
9. You are an executive and two of your employees do not get along together. Both are efficient people. It would be best to:
——Dismiss the less efficient employee.
——Give them something to work on together in which both are interested.
——Try to impress upon them the harm they are doing themselves.
——Keep both but give them different things to work on.
10. You are a waiter in a restaurant where tipping is the custom and a guest gives you a five-cent tip on a dinner which cost $1.45. Which would you do?
——Tell him he forgot his change and return the nickel to him.
——Tell him the tip is too small.
——Tell him that you don't accept tips.
——Take the money without comment.
11. You wish to give a book to a friend who is very fond of reading and are undecided as to the book. It would be best to:
——Find out from the friend what kind of books he likes best.
——Ask advice of book dealer.
——Give a book which you have enjoyed.
——Give him a "best seller."
12. You are invited to a formal six o'clock dinner at the home of an acquaintance. You should plan to arrive:
——At 5:00 in order to have time to visit before dinner.
——At 5:30 to be in plenty of time.

——At 6:00 in order to be prompt.
——At 6:30 in order to be fashionable.

13. Assume that you are a young woman engaged in a business occupation. You are taking luncheon with a young woman who is a school teacher, a slight acquaintance. It would be best for you to start a conversation about:
——Some current topic of general interest.
——An interesting feature of your own work.
——Present educational tendencies.
——Teachers' organizations.

14. An acquaintance is conversing with you about his hobby. The conversation bores you. It would be best to:
——Listen with a polite but bored attention.
——Listen with feigned interest.
——Tell him frankly that the subject does not interest you.
——Look at your watch impatiently.

15. A grocery clerk sells a regular customer some fruit which is well worth the price paid for it, but the customer is of the fussy type and returns it for a refund or something to replace it. It would be best for the grocery clerk to:
——Refuse to replace it on the ground that its quality was known before it was bought.
——Replace it in order to retain the patronage of the buyer.
——Try to convince the customer of its quality.
——Tell her he has sold the same kind of fruit to several other people and that they are satisfied.

16. A weak-willed young man has been trying to give up drinking. After two months of abstinence he finds himself at a party where liquor is served. He would be most likely to:
——Leave at once to avoid temptation.
——Suggest to others that no one drink.
——Drink to excess.
——Remain at the party but refuse to drink.

17. A business associate who has no authority over you tells you dictatorily to do a thing quite differently from the way you had intended. Which would you do?
——Ignore his directions and do it your own way.
——Do it his way without further ado.
——Tell him that it is none of his business, and that you intend to do your own work your own way.
——Tell him to do the job himself.

18. In planning a party to introduce an out-of-town cousin to a large group of girls it would be best to plan:
——A dinner.
——A dance.
——A tea.
——A theatre party.

19. Assume that you are a girl and that you meet an older woman on the street, a very slight acquaintance, whose eyes show evidence of weeping. It would be best to:

——Ask her why she is sad.
——Put your arm around her in a consoling manner.
——Appear not to notice her distress.
——Appear not to see her at all.

20. Assume that you are a professor of economics in a large university, and Smith, one of your students, complains that Jones, another student, is a socialist. You should:

——Send for Jones and tell him that Smith has complained about his socialistic belief.
——Ask some of the students to try to convince Jones of his error.
——Call Jones and prove to him that socialism won't work.
——Tell Smith to pay no attention to Jones' talking.

21. Assume that you are a teacher of a third grade and while going to school one morning after the first snow of the winter some of your pupils throw snowballs at you. From the standpoint of good school management, you should:

——Punish them then and there for not treating you with the proper respect.
——Tell them that if they ever do it again you will punish them.
——Report them to their parents.
——Take it as a joke and say nothing about it.

22. A man sixty-five years old gains some success as a politician in early life, but due to his straightforward policy he has fought a losing fight over a period of the last twenty years. He is most likely to:

——Maintain his losing fight.
——Turn over to the side of the political machine for success.
——Organize a new political party.
——Desert politics because it is so rotten.

23. Which person would be most likely to have a mental breakdown?

——The person who is a social butterfly.
——The person who does mental work for twelve hours each day.
——The person who has few interests in the world.
——The person who worries about trifles

24. Assume that you are a new officer of a town organization. The best way to gain your subordinates' respect and admiration without sacrificing your policies to them would be to:

——Yield all small points possible to them.
——Try to convince them of all your ideas.
——Make a compromise on all important issues.
——Advocate many reforms.

25. Mr. Avery is a very enthusiastic young man who has lost his job as assistant in the sociology department of a college for practicing

and advocating measures considered too radical by those in authority. He would be most likely to:

——Obtain another job and keep his radical ideas a secret.
——Obtain another job where beliefs and ideas do not count.
——Obtain another job in which he will have a chance to influence others by his ideas.
——Get his old job back by promising to change his ideas.

26. The bodies of an unscrupulous politician and a woman other than his wife were found in a lonely wood. The man had been shot once, the woman three times. Prints of a sharp heel were found on the face of the murdered woman. The person who committed the murder was most likely:

——A lover of the murdered woman.
——The wife of the murdered man.
——A political opponent.
——A fanatic reformer.

27. A child of ten frequently asks permission to go swimming in a dangerous lake. He will be most likely soon to stop seeking this permission if you:

——Let him go to the movies instead.
——Tell him about other children who have been drowned in the lake.
——Arrange for him to go swimming in a regular swimming pool.
——Let him go with his older brother and watch him swim.

28. A friend asks you to stay with an invalid father for two hours on an evening when you have a theatre engagement. It would be best for you to:

——Try to get some friend of yours to stay.
——Break your theatre engagement.
——Explain the engagement and offer to stay at another time.
——Offer to stay for a while and go to the theatre late.

29. If an aunt asks you to suggest Christmas presents for her to buy for other members of your family, it would be best to:

——Ask the other members of the family to give you a list of all the presents they want.
——Tell her that it will be more fun if she chooses the presents.
——Give her a list of the presents that you had planned to buy for members of your family.
——Give her several suggestions from which she might choose.

30. Henry Burton has held a subordinate position with a business firm for ten years. During this time the work assigned him has been quietly and reliably done. He is a man whom his employers will miss when he is gone. On obtaining an appointment with a new firm he will be likely to:

——Assume supervisory responsibilities easily.
——Impress his new employer immediately with his value to the firm.
——Be slow at creating opportunities for himself.
——Resign on receiving a slight criticism of his work.

TEST 2.—MEMORY FOR NAMES AND FACES

Included in the photographs below are the 12 individuals whose photographs and names you saw on the sheet which you studied at the beginning of the test. Below are the names of these 12 individuals. From the group below pick out the 12 persons whom you have seen before and write the number of each of these 12 in the parentheses before the name with which it goes.

( ) Mike Bailey. ( ) Ben Elliott. ( ) John Moore.
( ) Clifton Clark. ( ) Lee Higgins. ( ) Chester Sims.
( ) George Cook. ( ) Howard Jones. ( ) Sid Smith.
( ) Tom Edwards. ( ) Jake McDonald. ( ) Fritz Wagner.

TEST 3.—RECOGNITION OF MENTAL STATES FROM FACIAL EXPRESSIONS

The pictures below portray facial expressions representing 12 mental states. The names of these 12 mental states are given in the following list. In the parentheses before each mental state write the number of the picture which most nearly represents that mental state.

( ) Astonishment.	( ) Delight.	( ) Rage.
( ) Bashful appeal.	( ) Determination.	( ) Scorn.
( ) Contentment.	( ) Grief.	( ) Suspicion.
( ) Coquetry.	( ) Physical suffering.	( ) Terror.

Test 4.—Observation of Human Behavior

If a statement is true, encircle the T; if it is false, encircle the F.

T F 1. In pleasure the corners of the mouth are pulled down.
T F 2. We generally like those who bring us good news.
T F 3. All men are created equal in mental ability.
T F 4. The more uncivilized and superstitious a nation is, the higher is the rate of suicide.
T F 5. We are more shocked by our errors in etiquette than by those in logic.
T F 6. In fear there is a tendency for the eyes to become more widely opened.
T F 7. One of the surest methods of bringing a man to your point of view is by engaging in argument with him.
T F 8. By original nature we find it satisfying to be alone in our beliefs and opinions.
T F 9. With the average person there is no more pleasing sound than praise of himself.
T F 10. Pretense and sham are often inspired by the desire for social admiration.
T F 11. As a rule we should place little confidence in those who appear to love us extremely on slight acquaintance.
T F 12. The more intelligence a man has the more likely he is to be successful and happy at any kind of work.
T F 13. In order to know the real sentiments of others one should trust more to the eye than the ear.
T F 14. Few people hesitate to lie to escape an unpleasant engagement.
T F 15. Most of our likes and dislikes are acquired rather than innate.
T F 16. One of the most efficient ways to succeed in the world is an inviolate fidelity to friends.
T F 17. As a general rule it is not well to apply for a favor that you have little probability of obtaining.
T F 18. The desire for play ceases with the close of adolescence.
T F 19. Our standards of conduct are determined largely by our reason without reference to what others think.
T F 20. The tendency to reverie is more dominant from twenty-five to forty years of age than at any other time of life.
T F 21. The best way to prevent delinquency is to recognize that it is attractive to the delinquent and offer a substitute.
T F 22. Other things being equal, the more habits a person has acquired, the harder it is to learn new ones.
T F 23. The patriotism exhibited by the Americans in the World War was an example of carefully thought out judgment of the masses to stand up for the right.
T F 24. It is natural for us to enjoy the success of a friend without envy.
T F 25. One advantage of customary morality is that it adapts easily and readily to changed conditions.
T F 26. There is a marked tendency among old people to say that "the world is going to the dogs."

T F 27. Conscience gives the same commands to everyone.
T F 28. Recent attacks on the theory of evolution have resulted in greater freedom of speech.
T F 29. Most men resent taking orders from a woman.
T F 30. It is usually easier to predict the behavior of an individual than it is of a crowd.

Test 5.—Social Information

If the statement is true, encircle the T; if it is false, encircle the F.

T F 1. The nickname of the Chicago Nationals is Red Sox.
T F 2. The price of a new Buick automobile is less than that of an Essex.
T F 3. D. W. Griffith was the producer of the moving picture entitled "America."
T F 4. Election day for Federal officials comes in March.
T F 5. "The Dearborn Independent" is fostered by New York business men.
T F 6. Leland Stanford University is located in California.
T F 7. A white tie should be worn with a tuxedo suit.
T F 8. The Mayo brothers were famous automobile manufacturers.
T F 9. The term "right bower" is used in playing bridge.
T F 10. "They Knew What They Wanted" is a drama.
T F 11. Bud Fisher is the cartoonist and creator of "The Gumps."
T F 12. To become a Shriner one must first join the Masons.
T F 13. The National Beauty Pageant is generally held in Atlantic City.
T F 14. Loud speakers can be effectively used only on radio sets employing tube amplifiers.
T F 15. "The New Republic" is a weekly publication with a liberal attitude.
T F 16. The regular price of the Robert Burns cigar is three for a dime.
T F 17. The Little Blue Book series is published by the World Book Company.
T F 18. Ecclesiastes is one of the books of the New Testament.
T F 19. "Abie's Irish Rose" is a musical comedy.
T F 20. Coney Island is near New York.
T F 21. The "Liberty" weekly can be bought at newsstands for five cents per copy.
T F 22. In hotels run on the European plan the charges include both room and meals.
T F 23. In baseball, if the first two balls thrown to a batter are fouled they are counted as strikes.
T F 24. At a formal dinner where three forks are provided one should first use the fork on the outside.
T F 25. "The World Almanac" is a good place to find a chronology of world events for the year.
T F 26. A touchdown in football counts two points.
T F 27. Membership in Phi Beta Kappa depends primarily upon scholarship.

T F 28. Political party platforms are drawn up at the National Conventions which nominate presidential candidates.
T F 29. Whistler was the name of a famous vaudeville actor.
T F 30. The Waverly novels were written by Sir Walter Scott.
T F 31. The composer of "Humoresque" was Haydn.
T F 32. Telegraphic messages are sent at a reduced rate between 8 p. m. and 6 a. m.
T F 33. Most Junior High Schools include three school years.
T F 34. Clematis is a plant suitable for a border for a round flower bed.
T F 35. The Lincoln automobile is made by Henry Ford.
T F 36. The first score made in a tennis game counts fifteen points.
T F 37. The maximum speed attained by an automobile on an oval race track is over 135 miles per hour.
T F 38. The composer of the opera "Faust" was Gounod.
T F 39. The percentage of the fare paid for Pullman accommodations which goes to the Pullman company is 25 per cent.
T F 40. The Woodmen of the World make insurance their chief feature.
T F 41. The Pope of the Roman Catholic Church holds his office for life.
T F 42. Membership in the American Automobile Association is limited to members elected each year.
T F 43. Coal tar furnishes the greatest source of chemically made dyes.
T F 44. Charles Schwab is connected primarily with the coal industry.
T F 45. The United States Bureau of Immigration is a part of the Department of Labor.
T F 46. It is possible to obtain current fiction in "Everyman's Library."
T F 47. Pine is most often used in making moth-proof clothes chests.
T F 48. Lead plate storage batteries are ordinarily filled with a dilute solution of sulphuric acid.
T F 49. The philosophy of the Middle Ages was more materialistic than that of ancient Greece.
T F 50. A copy of every book copyrighted in the United States is deposited in the Library of Congress.

Test 6.—Recognition of the Mental State of the Speaker

Mental States

1. Admiration.
2. Ambition.
3. Despair.
4. Determination.
5. Disgust.
6. Envy.
7. Fear.
8. Hate.
9. Indecision.
10. Jealousy.
11. Loneliness.
12. Love.
13. Rage.
14. Regret.
15. Remorse.
16. Scorn.
17. Suspicion.

Directions: In the parentheses before each of the following quotations write the number of the word from the list above which most accurately describes the mental state of the person making the statement.

( ) And by his death you received the fortune which you so much desired; yet I wonder—I very much wonder—if there wasn't some foul play behind his untimely death.
( ) He has a very ancient and fish-like smell.

( ) How angry I am with myself because of the time I have wasted, the opportunities I have missed.

( ) The idea of asking those Baileys! They wouldn't know a reception from a strawberry festival.

( ) There's a real man; one who's not afraid to stand up for what he thinks is right even if the whole town is against him.

( ) Nay then, my last hope is gone—I can fight no longer.

( ) O that you had a thousand lives! One death is not enough for you. There's nothing I like better than seeing you suffer.

( ) When I make up my mind to do a thing it gets done; and this is one time that it's going to be done my way.

( ) I have been to blame! I killed him, but I loved him! May God forgive me! I have been to blame!

( ) In the future as in the past I shall strive to attain the highest places of fame.

( ) Cursed be my tribe if I forgive him!

( ) I wish you could invent some means to make me at all happy without you. Every hour I am more and more concentrated in you.

( ) Abhorred villian! Unnatural, detested, brutish villain! Worse than brutish! Go, sirrah, seek him. I'll apprehend him. Abominable villain!

( ) Which of them shall I take?
Both? one? or neither? Neither can be enjoyed if both remain alive.

( ) I am a lone, lorn creetur, and everythink goes contrary with me.

( ) Those horrid images doth unfix my hair,
And make my seated heart knock at my ribs.

( ) There is something in his eyes that tells me he is not playing straight; that's why I locked the door.

( ) I long once more to feel the pressure of your tender lips, liquid fire into my very soul.

( ) He is the greatest scientist that this country has so far produced. His discoveries will continue to bless humanity when he has long since returned to mother earth.

( ) The damning thought stuck in my throat
And cut me like a knife;
That she, whom all my life I'd loved,
Should be another's wife.

( ) If only I had not let that opportunity slip I might now be enjoying the things I have longed for.

( ) I had rather be a dog and bay the moon than to pretend to have courage and to act so cowardly.

( ) He is the rankest compound of villainous smell that ever offended nostril.

( ) Madly tossed between desire and dread.

( ) I wish I had your opportunity! Things are always handed to you on a silver platter, but I never get a chance to do anything.

( ) I am going to finish this piece of work if it takes me a year.

( ) Every sound makes me tremble. The least movement in the bushes makes my hair stand on end.

USEFUL TESTS OF PERSONALITY TRAITS

Downey Will-Temperament Test, by June E. Downey. Published by The World Book Company, Yonkers, N. Y. (Both individual and group tests available.)

Social Intelligence Test, by Fred A. Moss. Published by Department of Psychology, George Washington University, Washington, D. C.

Personal Inventory B2, for psychoneurotic traits, by Donald A. Laird. Published by *The Republican*, Hamilton, N. Y.

X-O Tests for Investigating the Emotions, by Sidney Pressey. Published by C. H. Stoelting Company, Chicago, Ill.

Test of Fair-mindedness, by Goodwin B. Watson. Published by Teachers' College, Columbia University, New York, N. Y.

CHAPTER XVIII

INTERESTS, SPECIAL ABILITIES, AND EDUCATION

Real interests should be distinguished from romantic glamour. There are many occupations, such as those of explorers or novelists, which attract through sheer glamour, but in which one would not be interested otherwise. It is an advantage, of course, if one is interested in the details of the work of some enticing pursuit such as exploring, but having one's picture in the Sunday supplements should not be confused with interest in the details of life which have made possible the accomplishment.

Several methods have been used to test the interests of the applicant. These are listed in the test sources at the close of the chapter. A useful common-sense inventory of the applicant's interests can usually be made during the personal inventory. The interests should be noted by detail rather than by occupation. For instance, the occupation of a machinist may involve fine attention to small details, or coarse work. The important factor is not the occupation of machinist, but liking fine or coarse work.

A useful check list to use during the interview, which is modeled somewhat upon Dean Schneider's original observations, is given on the following page:

INTEREST INVENTORY

Name of applicant..... Date.....
Interviewer.....

LIKED	DISLIKED	(Check one column at each end of the line)	MONTHS' EXPERIENCE
.....	.....	Working in a group, with no cooperation needed	.....
.....	.....	Working in a cooperative group	.....
.....	.....	Solitary work	.....
.....	.....	Work with small machinery, with fine adjustments	.....
.....	.....	Work with large machinery, without fine adjustments	.....
.....	.....	Work with people rather than machinery	.....
.....	.....	Work with books and figures	.....
.....	.....	Heavy manual work	.....
.....	.....	Light manual work	.....
.....	.....	Indoors work	.....
.....	.....	Outdoors work	.....
.....	.....	Work requiring great accuracy	.....
.....	.....	Work requiring handling others	.....
.....	.....	Fast, repetitive work	.....
.....	.....	Work involving sales contacts	.....
.....	.....	Work requiring close eye inspections	.....
.....	.....	Hazardous work	.....
.....	.....	Work which varies from day to day	.....
.....	.....	Work with the opposite sex	.....
.....	.....	Work with other nationalities	.....
.....	.....	Work with people of different religion	.....
.....	.....	Work in a smelly place	.....
.....	.....	Work in a noisy place	.....

The interest inventory can be expanded for the special requirements of individual concerns. An "Interest Specification" can likewise be made for each occupation within the plant.

A few applicants will maintain during the interview that they like every kind of work and working condition. If the interview is handled skillfully in a conversational manner this pitfall can usually be avoided. The purpose of the column headed "Months' Experience" is to give a check upon the likes of the applicants who state that all the features outlined are liked.

There are a few individuals, who border on the abnormal, who can be interested in nothing, who like nothing. There are a few others who are fascinated with anything they happen to be doing.

It is unreliable merely to ask an applicant how he liked his work as assembler. The morale of the entire plant may have been low, and he will in fairness say he did not like the work. But when

the important details of the work are inventories for his interest in them, the entire picture is changed.

Interests in total occupations may change from time to time, especially in the case of those under the age of thirty. The detailed interests, however, do not change so markedly. The cause for these changes is a matter for conjecture. It would not be suprising, however, if a part of the changes were due to failures to build morale in various plants.

It has also been experimentally shown that, in general, the best work is done while the individual is engaged in doing what he likes. The correspondence between liking to do a thing and ability in doing it is not always found, as is shown by the writer's liking for playing the piano. Aside from the possibility of interest indicating ability, the most important fact is that morale is higher if the worker likes his work. This should be one of the primary considerations in placement.

DETERMINING SPECIAL ABILITIES

Experience in various occupations and the salary received in them are indirect evidences of special ability. There are several useful tests for the measurement of special abilities which are valuable to supplement these other estimates. The tests of special abilities, however, are a measure not of training and proficiency so much as they are of capacity for profiting by training and gaining proficiency. They are predictive; they look forward, whereas salary received looks backward.

These tests are too numerous and too complicated to be given detailed consideration here, but the most commonly used tests are listed at the close of the chapter. They include tests for clerical aptitude, file-clerk aptitude, and mechanical aptitude. To a large extent they are work-sample tests.

THE MEASUREMENT OF EDUCATION

It is refreshing to employ a stenographer or typist with the assurance that she really can spell or is able to correct the dictator's grammatical errors. There are excellently standardized educational tests for such subjects as spelling, grammatical construction, penmanship, and arithmetical reasoning. For many positions it is desirable to have more accurate information about an applicant's ability to spell than is given by the recom-

mendation from her previous employers. These standardized educational tests become useful in these situations. A series of such tests are listed at the end of the chapter.

TESTS OF VISION AND HEARING

A micrometer is no better than the eye that uses it. Surveys have revealed that about one-half of factory workers have defective vision which should be corrected by glasses. It is not the function of the employment manager to prescribe glasses, but he obviously should not place a man at work for which he does not have adequate visual keenness. And yet the case was recently called to my attention of a manufacturer who discovered that a group of inspectors did not have vision keen enough to detect the imperfections for which they were searching.

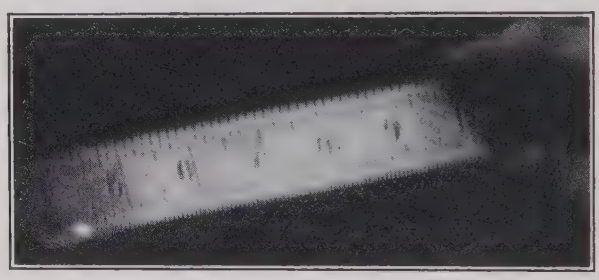


FIG. 155.—A ruler looks this way to the applicant with a moderate degree of astigmatism.

A vision chart is illustrated in the figure. This is to be read by the applicant at a distance of 20 feet. Each eye is to be tested separately. In employing workers for work that is done at a close distance, the Near Test, supplied by the Eye Sight Conservation Council, should be used. It is advisable to have the eyes of applicants tested by the medical department and glasses secured when their need is indicated. In cases where no medical department is available, the vision chart illustrated can be used by the employment manager to the advantage of the firm and the applicant. If the applicant is not able to read the normal line at a distance of 20 feet, he should be referred to some physician with whom the firm has an arrangement for assistance. Defective vision, which is very common, will result in a poor quality of work, and cause accidents and fatigue. This should be remedied before the worker is given his payroll number.

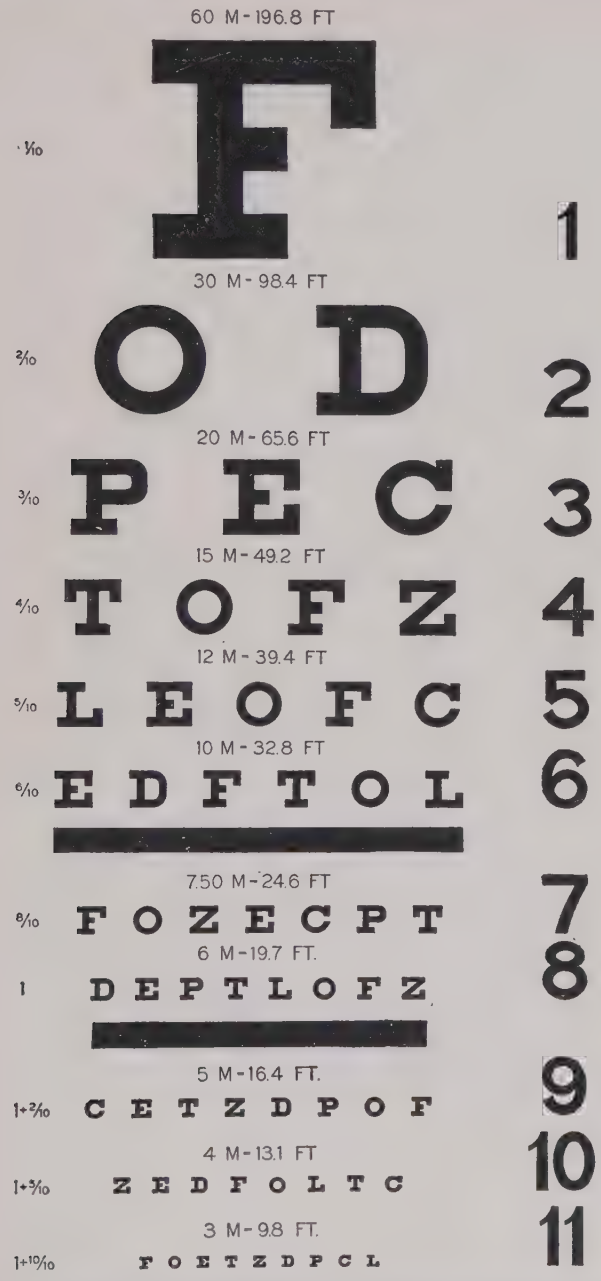


FIG. 156.—Vision chart, greatly reduced, for testing acuity of eyes, one at a time. A green line is under row 6, a red line under row 8, to give a rough test for color blindness. Line 1 is $3\frac{7}{16}$ inches high in the unreduced chart and should be read with one eye at 196.8 feet.

The "whisper test" is the most commonly used test of hearing. It is, obviously, not especially reliable. Each ear should be tested singly. Unfortunately, defective hearing cannot be corrected as readily as failing vision. Applicants with dulled hearing can be placed in the noisy places around the plant to advantage, especially since the fatiguing effect which is being demonstrated for industrial noises can be lessened to some extent by this subterfuge. Deafened applicants should not be placed at work where oral orders are given or where production is in any way dependent upon hearing ability.

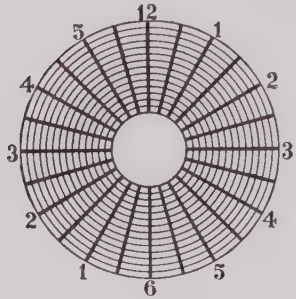


FIG. 157.—All the black radii are of equal blackness, but some eyes see some of the radii as blacker than others. This defect is astigmatism. The chart is reduced in the illustration.

About three out of every hundred workers are color blind. This defect cannot be remedied. One simple test is matching the colored yarns of the Holmgren Test for Color Blindness. Another simple test, and probably the most effective, consists of a series of colored mosaics. On one of these the normal eye will see the numeral 12 formed by a line of colored dots, while the color-blind eye will see no numerals outlined. This is the Isahara Color Blindness Test.

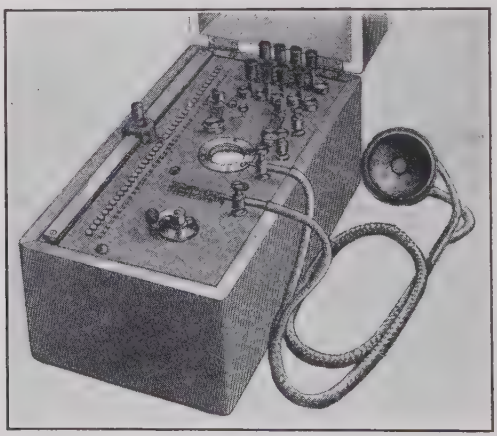


FIG. 158.—An audiometer which produces a sound of electrically controlled loudness for testing hearing.

In the larger employment departments, a member of the medical department should be detailed to give these sensory tests, and to decide what occupations within the plant might impair the applicant's health.

PHYSICAL SPECIFICATIONS

A commonly overlooked factor in employing workers is the physical relations between the applicant and the work he is engaged to do. A short man should not work in a deep ditch

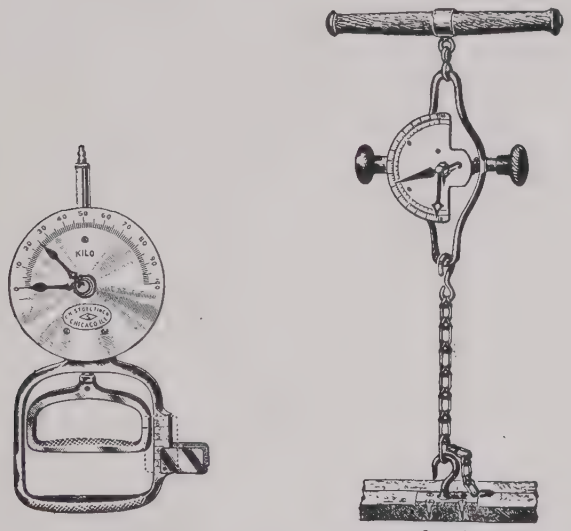


FIG. 159.—Dynamometers are used to test strength. The small one to the left is to test the grip of the hand, the one to the right is fastened to a hook in the floor and is used to test the strength of the back by the applicant pulling upward.

or in a storeroom with high shelves. Small hands disqualify applicants for other positions.

The general strength of the applicant can be estimated by casual inspection or the modified compression-spring scales known as dynamometers may be used. Many employment departments have height and weight and hand-spread specifications for various positions within the organization. These are simple to establish and are a good investment for the time of the employment department during a slack season. As a matter of fact, the physical specifications, as well as the other test specifications, are probably important enough to warrant any employment

department which is at present without such standards to start at once to provide these as quickly as possible. It is time to cease being the Oracle that sums up a man's fitness from his gait, his facial profile, where he has worked, and what another plant which is glad to lose him has to say in a confidential way. If this book stimulates even one hundred employment departments to accept this opportunity and helps to point out the way the author will feel repaid for a book which is written for just that purpose.

In a beautiful little life of Major Frank Gilbreth, it is written by his brilliant wife that Frank has gone, but *the Quest* goes on. In a similar spirit of industrial advance, it is hoped that this book will help you carry on *the Quest.*

USEFUL TESTS FOR INTERESTS

Occupational Interest Blank, by Max Freyd. Published by C. H. Stoelting Company, Chicago, Ill. (Separate blanks for men and women.)

Vocational Guidance Score Blanks, by John Brewer. Published by C. H. Stoelting Company, Chicago, Ill.

Analysis of Work Interest Blank, by J. B. Miner. Published by C. H. Stoelting Company, Chicago, Ill.

USEFUL TESTS OF EDUCATIONAL ACHIEVEMENT

Powers General Chemistry Test, by S. R. Powers. Published by The World Book Company, Yonkers, N. Y.

Wilson Language Error Test, by G. M. Wilson. Published by The World Book Company, Yonkers, N. Y.

Thorndike Handwriting Scale, by Edward L. Thorndike. Published by Teachers' College, Columbia University, New York, N. Y.

Completion-Test Language Scales, by M. R. Trabue. Published by Teachers' College, Columbia University, New York, N. Y.

Thorndike-McCall Reading Scale, by Edward L. Thorndike and W. A. McCall. Published by Teachers' College, Columbia University, New York, N. Y.

Sixteen Spelling Scales. Published by Teachers' College, Columbia University, New York, N. Y.

USEFUL TESTS FOR SPECIAL ABILITIES

Stenquist Mechanical Aptitude Tests, by John L. Stenquist. Published by The World Book Company, Yonkers, N. Y. (Two Tests.)

Thurstone Employment Tests, by L. L. Thurstone. Published by The World Book Company, Yonkers, N. Y. (Clerical work; typing.)

Thurstone Vocational Guidance Tests, by L. L. Thurstone. Published by The World Book Company, Yonkers, N. Y. (Five tests designed for

use with engineering students. Technical information test is especially useful.)

Assembling Test of Mechanical Ability, by John L. Stenquist. Manufactured by C. H. Stoelting Company, Chicago, Ill. (An individual test in which various common mechanical contrivances are to be assembled.)

Constructive Ability Test, by T. L. Kelly. Manufactured by C. H. Stoelting Company, Chicago, Ill. (Adaptation of the puzzle-block idea to a test which can be given to four applicants at a time.)

Clerical Test K, by Eugene J. Benge. Published by C. H. Stoelting Company, Chicago, Ill.

Filing Test, by W. D. Scott. Published by C. H. Stoelting Company, Chicago, Ill.

Reasoning Test, by L. L. Thurstone. Published by C. H. Stoelting Company, Chicago, Ill.

Ingenuity Test, by L. L. Thurstone. Published by C. H Stoelting Company, Chicago, Ill.

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